

How to Develop Metals, In Depth

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1. Summary : Global methodology :

Reaching the result you want is a matter of **balance** between :

- The "colour" parts, diffuse and ambient strengths
- The highlight parts : shapes and strengths
- The reflection part : Total reflection strength and type, and this last one is, on its own level, a balance of two elements : Rays contribution and Map contribution.

The resulting component of all these settings is finally modulated by surface deformations, which are often a key factor of realism for metal rendering.

The right balance is reached once you have the look you want for the metal, and when it gives the impression of being "energy conservative" meaning that under various lighting conditions, you never have the impression that there is either too much light, or not enough, out of your surface.

This result can be reached in a few steps .In brief, once your model chosen :

1. Apply your basic diffuse and ambient components (colours, strengths, maps) keeping in mind the following ideas : Try to keep a low diffuse, (the more polished is the metal, the lower the diffuse component must be), and Ambient is there to ensure a basic power and colour out of the surface "whatever the lighting condition". Ambient is a good lever to act on to give to your surface the impression of "energy conservation".

2. Choose your highlight type, isotropic or anisotropic model,

3. Immediately add surface defects, with not a too high strength at the beginning (around 20%-40% for instance). Load one of the preloads of folders 04 and 05 and adjust the strengths of them.

3. Add lights (4 lights provided by instance) and make a first render. Test several tiles and strength settings of normal and MR displacements. Steps 3 and 4 are pretty "interlaced".

4 Rely on these first renders and the metal you want to create Shape and **adjust the strength and shapes of the highlights using** the parameters included in "Specular". Don't try to reach the perfect result right now since the result may be altered by your reflection settings. Eventually go back to step 3.

5. Go to the reflection part. Now you have to think : do you need your metal to reflect "really" the surrounding props? If no, keep ray trace contribution at 0, and then all your work on your map based reflection parameters. Choose color and strength of mapped reflection, and test under various light settings and camera position and distance. You can also load alternate reflection maps, or use your own ones. Eventually go back to steps 3 and 4. You can eventually do step 5 before step 4.

If you want to mix with ray trace, increase the ray trace contribution, increasing ray trace reduces the applied strength of map 1. If you need to compensate this, then two ways to do that:, Either you can force the total reflection out (Set More Reflective), or you can increase the power in map 2 (where is written keep low). Map 2 is the constant base of reflection independent of the ray tracing contribution.

6. Now make your final adjustments :

Repeat steps 1 to 5, but this times with only limited parameters optimisation around the setting point you reached.

2. Basic Settings : choose your shaders

How do you begin?

You have several options to begin with depending on how far you already went with your material :

- **either** you create your base material as you would do usually, and afterwards apply one of the Shader Applier. In this first case, you may lose some of the maps (Specular Strength, Reflection Map..), and then have to reapply the missing image maps in the right input. In this case remember that it still belongs to the list of the maps which DAZ Studio will propose when you left click on the image map.
- **Or** you apply one of the Shader Applier first, and then you plug your image maps in the right inputs.

It will probably go faster if you use

- **the first** option (create and then apply) on an existing material,
- and **the second option on a new material you create from scratch.** (begin with all the inputs).

Which of the shader applier will you chose?

Metal 1 are based upon Blinn Model for Specular, and the highlight is isotropic, meaning that you cannot enlarge it separately in one direction or another. Metal 2 relies upon an anisotropic Ashikhmin-Shirley BRDF model, being an anisotropic version of the famous Phong one. You can then shape the highlight differently along two different axes of your object, with results depending on curvatures of objects, light positions, and anisotropy factor chosen. There are differences between both of them, and do not react to light and object shape the same way. It would take years to explain the difference, that is why I would say : just test for YOUR configuration. One warning then, ***if you switch between metal models in a DAZ Studio scene, sometimes, you may have to save and reload your scene for DAZ effectively take this into account.*** You will know if you have to do saw by having a look at the name of the shader shown at the top of the Surface editor. For the first one you will see "Shader : V3DAMC_Blinn" , for the second "Shader : V3DAMC_Aniso01". In general you don't have to switch except when you choose it. There is some important differences regarding the shader base included in the "Advanced Metal Shaders" Product.

First the tiles have been remade so that now the visible tile in the preview mode correspond to the one of the "diffuse/specular/ambient/opacity" one.

Then you now have 3 displacement maps.

- One dedicated to enhance the "texture supported defects" (visible on diffuse map for instance), which tile is the same one as the diffuse map. This is the texture displacement map.
- One dedicated to add defects on your material, independently from the underlying texture. This is the Material related displacement, and has individual tiles.
- The last one a "Pattern" displacement map. This is the one which is used when you want to add a pattern or drawing uprising from your surface. This is the classical displacement map you know so well, and presents independent min, max, and tiles too which names are preceded by "OPD" or Offset Displacement".

What if I want to change the shader type but keep my maps?

Well it is easy :

- a. Select your surface and in editor, just do : copy selected surfaces.
- b. Then apply the shader applier you want to switch to by double clicking on it.
- c. And in the surface editor, just do : paste to selected surfaces.

You will then find the same maps, inputs, the supporting model will have changed. Just one warning there : you will have to adjust your Glossiness and Spread in Specular for model 1, and your "Larger" Drivers of Specular in Model 2.

3. Parameters Description and Influence

3.1. Initial Example - First Time Appliers

I decided to chose the North Area of the "Briefing Room", because I remember I suffered so much on the metal parts of the coffee pots (and not only) when I made them. PLEASE NOTE : Some of the initial settings of appliers have be optimised after I made this tutorial. This will not prevent you to understand the global approach of the development of a metal using these appliers. You may just be astonished of the initial difference in the renders if you try to follow the tutorial step by step. Here is the first render with 4 infinite lights, with a focus on the coffee pots.



Now I chose to have a Anisotropic based Specular. That is why :

1. I select my **RIGHT coffee pot** metal surface (this allows to keep the reference),
2. Double click on AMC_Metal2_BaseApplier, and render, this is the following image on the left. There is already a nice difference in terms of highlights on the right coffee pot.
3. I select my **LEFT coffee pot** metal surface, and do the same. This is the image on the right.



Right Coffee Pot Metal2



Both Coffee Pots Metal2

What if I choose the Blinn based Specular?

I keep the same base settings - brand new scene - and I apply the AMC_MetalType1 (Blinn)

I won't have the same result at all, as shown on the next image.

For now, I find that the Metal 1 (Blinn one), presents the best results (this is a personal opinion, only a matter of taste). It does not mean that it is the one to choose automatically. It just means that on this object, with the initial maps included, under these base lights, and with the default parameters included in the presets, Metal1 looks better than Metal2.

Here the two images, top first the Blinn Model, second one the Anisotropic Model.

With Metal 1 Applier (Blinn):



With Metal 2 Applier (Anisotropic) :



3.2 Material Adjustments

In this example decide to keep initially the Blinn Metal (Metal 1) and to optimise it the way I want to. Concerning Specular and Reflection parts, I will detail the parameters for each metal types.

If you want, there are *also in the product plenty of metal presets you can load, and then apply on them rough metal or polished metal presets, you can try to apply to get closer to your final expected result.* It may help you to see better how this works.

Then you just have, if needed, to replace my maps with the maps you created and you want to use for your own objects.

SINCE NOW ONLY THE RIGHT COFFEE POT WILL BE MODIFIED in order to always have the reference to compare with. The reference is metal 1 (Blinn) on left coffee pot.

3.2.a Influence of Colour Components

Colour components will just influence the colours in or outs of the highlights. They **exclude** everything concerning bump, displacements, normal maps.

3.2.a.1 Ambient :

First I find that the material parts out of the highlight are two dark. Let's increase them. Ambient work as usually : it applies an ambient component whatever the light condition.

The initial ambient colour and strength are a 179,179,179 grey at 50%.

First let's force ambient strength at 80%.

The metal is globally more clear.



Now you can also keep your 50% ambient strength and modify *to colour applied to the ambient map.*

If I apply a pure white ambient colour, the result would be sensibly the same as increasing the strength only since it starts from a grey to go to a white.

What is interesting is to immediately **use the ambient colour to influence the base tint of your object.**

For instance, I come back to a 50% strength but I apply a (232,210,187) colour to the ambient, and then I go for a warmer tint.



In summary you can : 1. map your ambient, 2. change colours and strength, this will influence the *base tint of the object whatever the lighting conditions*. **Note that if you increase reflection later on, then you may have to reduce ambient +/- diffuse.**

3.2.a.2 Diffuse :

Another parameter you know so well, and which works as usually.

The principles remains the same as the ones for ambient, except that they will be visible mainly for the object surfaces which receive lights. Mixing different ambient and diffuse colours can present very interesting results.

First step, I increase Diffuse Strength from 30 up to 60% and apply a cold color (178,191,189). Now if we compare left and right coffee pot, the result is colder, and more light is going out the parts out of the highlights.



In general, Ambient is higher than Diffuse. The more "mirror polished" reflection you need (not rough), the less diffuse - and ambient- component you will need, since outgoing energy will come from reflections. Ambient will then just be there to add and adjust a constant color base to your material. The more "rough" metal you have, the more you CAN increase diffuse but generally, diffuse component must be kept pretty low, with bigger ambient or reflections contributions.

3.2.b Specular and Reflection Components :
3.2.b.1 Specular / Model 1 (Blinn) :

In specular you will find parameters you know such as strength colour and glossiness. You will also find another parameter called "isotropic spread around initial spot".

Glossiness and Spread work together - for model 1 only!

Glossiness works the way you're used to, and spread will more or less focus your highlights around the initial highlight spot. They have the same "type" of effect, but they act in a different way, and this is what is allowing you to shape your highlights. Then once the Highlight shape is defined you may have to readjust other parameters. For instance when you shape your highlight for very small highlights and see that everything out of the highlight is too dark, then increase ambient diffuse or reflection. [Here is an example of different step of a material set-up :](#)

Glossiness	80	70	60	50
Spread	0.01	0.05	0.1	0.2

First a shaping of the highlight using Glossiness and Spread.



[set Glossiness at 55, Spread at 0.036, adjust the other parameters :

Other important parameters for colours are in Diffuse Ambient, Reflection



Diffuse (color, strength)	Grey, 30	Yellow1, 40	Yellow2, 35	Same
Ambient (color, strength)	Grey, 50	Blue1, 60	Blue2, 40	Same
Reflection Map	Initial	Initial	Initial	Map :Clouds BlueNOrange

What is also important to notice when adjusting highlights is that "somehow" a part of of the reflection map is, for model1, sent in the specular highligh surrounds.

For large highlights, this implies that you may need to decrease the reflection map1 parameter too in order to adjust your highlight strength.

3.2.b.2 Reflection / Model 1 (Blinn) :

Metals reflect their environment.

In these metals you can increase ray tracing contribution regarding map contribution, and you can also force reflection. By default, the metals presets have a zero ray trace contribution, and no forced reflections.

The first thing you may want to do is set the right environment map for your metal. These metals include an by default an environment map, but you find many other included maps, most blurred, some crisp. I think it is more interesting to use the blurred ones so that it gives the feeling that there is something around your object without being too clear regarding what it is.

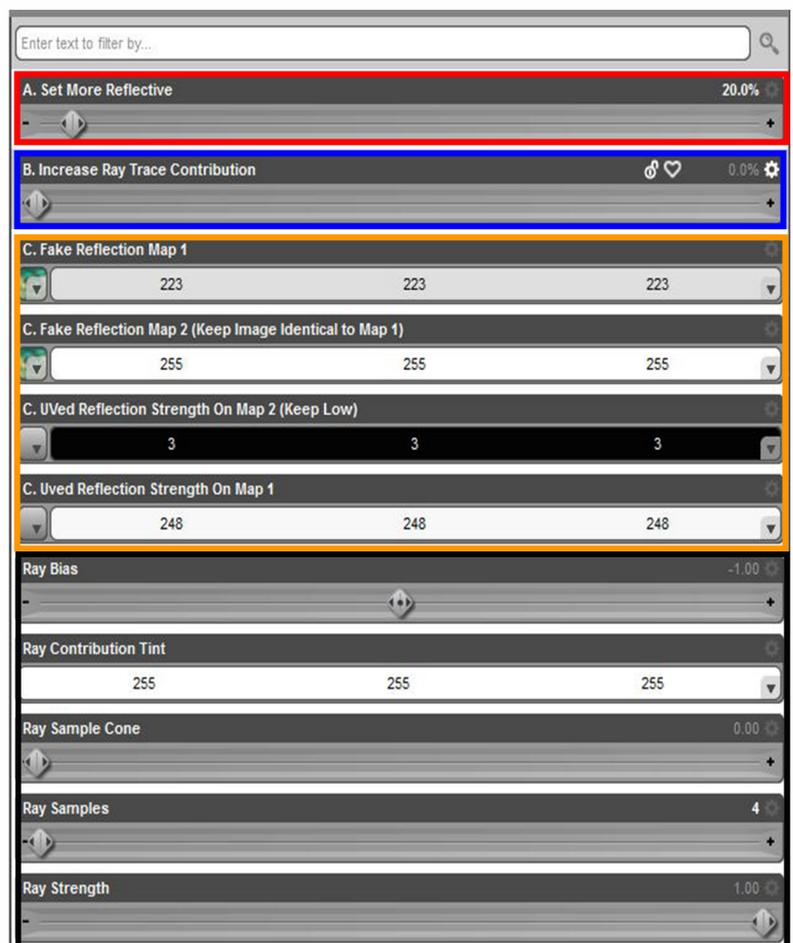
In the following image, a summary explaining how reflection now work :

THIS PARAMETER OVERRIDES DAZ DEFAULT MATERIAL AND ADDS REFLECTION, WHATEVER THE REFLECTION TYPE TO THE FINAL RESULT. TRY TO KEEP BELOW 100.

THIS PARAMETER INCREASES THE PART OF RAY TRACING IN TOTAL REFLECTION WHILE DECREASING THE MAP PART.

THIS IS A BIT MORE COMPLEX. BY DEFAULT MAP 2 IS ALWAYS APPLIED. BUT WITH AN EXTREMELY LOW STRENGTH. THEN FAKE REFLECTION MAP WILL BE ADDED TO MAP 2, TAKING INTO ACCOUNT NOT ONLY THE STRENGTHS AND COLORS APPLIED ON IT, BUT ALSO WITH A GLOBAL STRENGTH INVERSELY PROPORTIONAL TO INCREASE RAY TRACING CONTRIBUTION. RAY CONTRIBUTION AT 1 WILL "KILL" THE MAP 1, RAY CONTRIBUTION AT 0 WILL KEEP IT INTACT.

THESE ARE IN ORDER TO MANAGE YOUR RAY TRACING PARAMETERS



One thing you may notice is that the strength of Reflection are driven by colour levels instead of usual percent drivers. Just use the colour level as a driver (0,0,0) colour is a 0 strength and (255,255,255) is a 100% strength. Same remark applies for a few other drivers.

More precisions in the behaviour of all these parameters can be found in part 3.2.6.a. MORE TRICKS are also available in 3.2.b.4.

Now it is possible to adjust all these settings but what must absolutely be taken into account, as a content creator, **is the fact that if you decide to use a purely ray traced reflection, then all the users who will put your prop in the scene without a "rich" environment will be disappointed! You will meet the same problem if you remove the environment maps.**

Why? Because they will probably won't have a rich environment around your prop. As a consequence nothing or almost to be reflected on the metal, which will not look like a metal anymore. So either you put a note explaining that either a rich environment or a phantom ("phantom") ray trace map is required, or you go for more balanced ray tracing and map mix.

So try and test and adjust the best way you think regarding your product (for instance if you have a metal object in the middle of a scene including other props, then you can go more on ray trace).

Here is an example with the coffee pot, which is included in the north area of the briefing room.

I set More Reflective at 100, Add Ray Trace at 50.

After the first render here is the commented result.

Houston, we have a problem!
 There is nothing to be reflected Here.
 Since Ray Trace Contribution is only 50, There is a bit of map, the result is not TOTALLY Black, we guess something But : not sufficiently regarding the ray trace.



Here the reflections of the other coffee pot and the Fax this is enough.

I loaded only the North Part Of the Briefing Room. In order to have something to be reflected on the black area, I can Load the missing Parts of the room to have a 360 degree environment of Props. Then we will see alternative solutions, when no environment can be loaded.

I add the rest of the briefing room and render. Since I have a full environment of real props around my coffee pot, I can adjust my settings :

More Reflective at 0, ray trace at 100.



A 100% Ray Tracing seems too much for a coffee Pot. This is a coffee Pot, not a Mirror!

Ray tracing seems too much at 100. Let's try a 25 percent influence :



This looks much more like a "coffee pot" could reflect its environment.

Now the problem is : what if I have no "real props environment" around my own object, but I still want it to reflect potential surrounding objects?

Well, keep your ray settings, and the job is to increase the map base contribution.

- Increase Uved reflection strength on Map 1 if it is not already at max.
- Also set colour of Fake Reflection Map 1 as high as possible (trying to keep your tint if needed)
- If necessary, increase the contribution of rays for the reflected objects to be visible.

In the following example, **I have no other props environment "back camera"**, and the compromise is :

- Set More Reflective 0
- Ray Trace Contribution : 50
- Map Color : (255, 255, 255)
- Uved Strength on Map 1 : (200, 200, 200)



At this stage of reflection settings, you can eventually re-adjust your other colour and highlight parameters such as ambient, diffuse, and specular, to optimise the material regarding its new reflection properties, what I did in the following image for instance in for the coffee pot.



Remember : it is not obligatory to have a metal making images of the environment - or mirror polished metals ! You can perfectly chose to have a rough metal!

What else is important to know :

Why are there two maps in the reflection? In order to be able to "kill" the mapped reflection when ray tracing in up. In order to obtain this, the Reflection map 1, is added, with the corresponding map 2 (at their respective strengths), with a (it does not appear in the parameters) 100% influence when ray tracing is 0, 0% influence when ray tracing is 100% and above.

What does it imply?

Map 2 is your constant map based reflection when Map 1 is driven to zero via increasing ray tracing. That is why it should be kept low. Yet, you can use the strength of this second map it as a new driver parameter for increasing the mapped reflection when ray tracing contribution is increasing.

Other important points? Calculated reflections will depend a lot on the displacements, normal maps, and bump strengths you are using. **If you feel you do not manage to have crisp enough reflection of your environment, decrease these strengths.** Find the best compromise for you.

What Else? AMBIENT is generally made to compensate the lack of really reflected ambient light. **When increasing your reflection, if you feel the total output power seems to go higher, than you can solve this by decreasing the ambient (and eventually diffuse too) strength and or colour of your prop.**

3.2.b.3 Specular / Model 2 (Anisotropic) :

The second specular model is an anisotropic one and presents several features in term of highlight size and shape. The principles of what I explained concerning Diffuse and Ambient Components remain pretty roughly the same.

First of all, you have to note that the highlight cannot be set to zero, even if your specular strength is 0. You can then "zero" your highlight anyway if you make them very large!

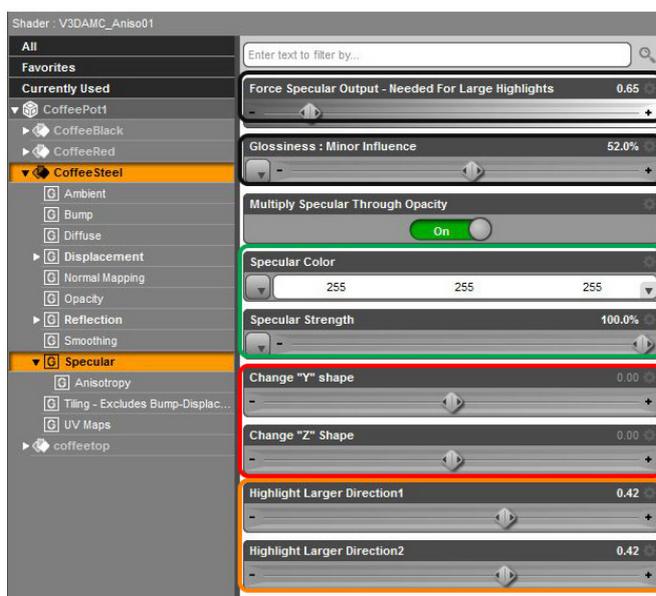
Then you have to remember that there are two main drivers to the highlight shape, both in specular. They are called "Highlight Larger Direction 1" and "Highlight Larger Direction 2". And they do exactly what they are supposed to.

Please also note that the results are dependent on glossiness BUT, with glossiness change with only a very low contribution the final result. I would say in most cases a minor contribution.

You have 3 additional Drivers :

- The two first will deform the highlights, and can produce really interesting results. They are the "change "Y" shape" and "change "Z" shape".
- The last one can be used to increase the Specular Strength far above the limits and is required probably almost only for very large highlights and very rough (in term of displacements) surfaces. This is the first line, "Force Specular Output". Concerning this last one :

One more point is that the "strength" of the result is also less dependant on the strength parameter as you are used to. There is a natural limitation due to DAZ default material resulting in the fact that even increasing the strength above limits, it will be insufficient. That is why an additional parameter has been included to increase this strength over-riding the Default material. You will probably need it as soon as the "Larger" dials will raise over 0.4.



To Increase Strength. Mainly with large sizes.
More Efficient than Specular Strength

Glossiness : Low Impact On the result

These are Your Usual Settings
Except that a 0 Specular
Will not result in a 0 Highlight.
To "0" the highlight, just set it very Big!

These are additional
Parameters for you
to "Deform your Highlights"

Most Important, Increase the Highlights Size in
two different directions independantly

First, let's try to change Highlights in an "isotropic" way, meaning that you change both values but you keep them equal to each other.

Important note there :

The result in term of highlight size depends not only on the values you set for "Highlight Larger", but also on :

- The shape of the object, the direction of the light and angle of the camera (like in "real life"), the "Deformations" of your objects. The more you will add displacements and similar deformations to them, the more the final highlight will be modified by these deformations.

If you chose very small highlights (for instance 0.1 and 0.1) on objects with a lot of displacements, you will obtain a sort of small discrete points of lights over the highlights. *In this case, you have decrease the deformations of the surfaces, most often by decreasing the displacements, normal and bump strengths.* **And this is logical** since small highlights generally correspond "in reality" to polished surfaces.



Bellow a certain value and DEPENDING on the size of your object (and position of lights) the highlight might disappear (too small).

Above a certain value, the highlight will disappear too. But not for the same reason. While becoming bigger, the energy out of them has been "diluted", "spread" on the surface. Then you have to increase this energy, first by increasing "specular strength", and *if not enough, by increasing "Force Specular Output"*, as illustrated below.



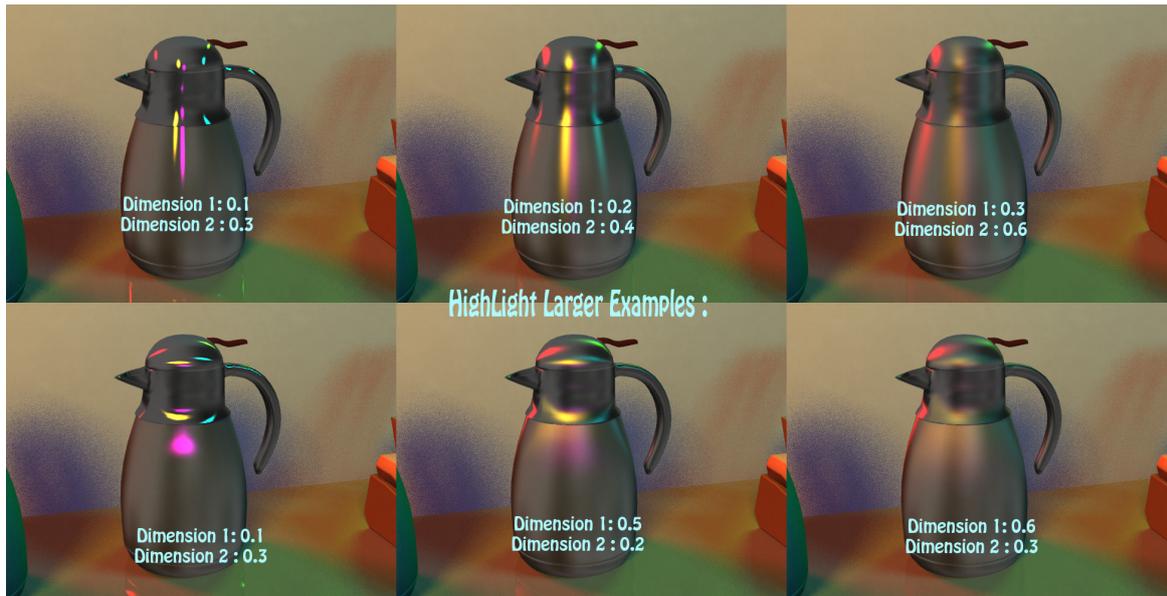
In general, I would not tend to make "Highlight Larger" above 0.3. This is my limit, but it depends on the objects shapes and effects you want to reach too.

Concerning Anisotropy : You can change in a different way the values of Highlight size in direction 1 and 2 (globally horizontal and vertical).

In order to see the influence of the different light and Shapes, I decided to apply one colour for each infinite light, and to add one distant light in the exact axis of the camera. I think that the following images illustrate well the influence of the different parameters on the beam shapes.

I also applied the material base to the top of the coffee pot in order to see better how the result also depend on the initial shape of the object.

For too small values of "Highlight Larger", remember you might not seem your beam. For now the min of these values are set at 0.1, but you can removes them if needed.

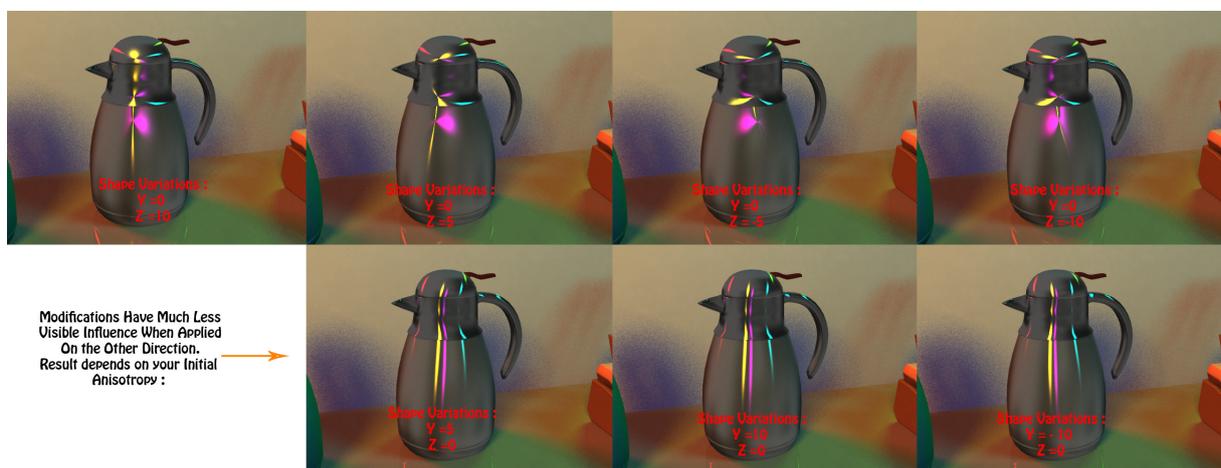


Now the two last parameters change the shape of the produced highlights.

Please note that the result depends a lot on the anisotropy chosen for the initial Highlight :

With an anisotropy defined by a smaller Largeness in Direction 1 than the one in Direction 2 the influence of the "change "Y" Shape and change "Z" Shape will have MUCH more influence in term of pure "deformation" than when it is the contrary.

When, on the contrary you have a Larger spot in direction 1 than the one in direction 2, you will tend to "rotate" the highlight beams without deforming them too much. This also depends on the curvatures of the object : **the more curvy, the more visible the effects of these changes. It also depends on the shape anistropy itself.**



3.2.b.4 Reflection / Model 2 (Anisotropic) :

The reflections for model 2 work the same way as for model 1.

In Brief :

The total reflection include both Map based reflection and Ray traced one.

Ray traced reflection is added to environment map2 whatever happens, with a basic strength depending on your ray tracing contribution, (dialled by "Increase ray tracing contribution").

Map 1 is added to this base reflection with : a 0% strength when ray tracing is set to 100% and above, and a linear variation up to 100% when ray tracing is set to 0%.

The sum of all this can be increased above theoretical limits using the "Set more Reflective Dial".

Note that in order to allow a maximum of situations to be covered, I deliberately include very wide limits. Do not put all at maximum, or you will have "bright white" results, often presenting artefacts, these artefacts being due to the fact that your colour is far above 1, and this cannot be handled properly by the render.

Remember that the total output power "surrounding" the prop is also influence by ambient, in general it is recommended to decrease ambient contribution if environment map one is increased.

Metal 1 and 2 do not react the same way to reflection settings, this is why in general you will not obtain the same results using the same set of parameters. In my case of figure, I chose here to load some of the included "polished metal presets" for metal 2, in order to have some "starting points" to optimise the settings.

Note that all these polished metal reflection presets are organised by a convention name. First, and this is the beginning of the name :

1. Map Or Ray. Map means this is much map based than ray based, and Ray.. The contrary.
2. Then the name goes on with "Medium" or "strong", defining if the respective map or ray contribution is just medium or strong.
3. The rest of the name defines the Highlight : Weak, Strong, Medium, eventually large.

So for instance : "AMCM2_MapStrongHLWeakLarge" preset means that you are working with metal 2 and you choose a strong map contribution and a weak and large highlight.

Here you can find the initial renders for three of the included presets :



For the previous renders, I chose a strong highlight because the curvature of the object I'm working with is low, which tends to reduce the highlight effects. From the previous render I conclude that I want a configuration between "Map Medium" and "Ray Medium".

Here is step by step how I optimise my reflection settings for this prop.

You will find the illustration of this step by step on the next page.

0. First I load in the reflection map presets an environment map with more details than the initial one. I chose the EnvMap_Frac5. This is not obligatory, I just want to have a good density of details.

1. Then I begin from the ray medium setting and decrease Ray trace contribution from 50 down to 10 percent. I render and realise now that the map contribution is too visible, but the ray contribution (reflected objects around) seem to be at a convenient level.

2. So I decrease set more reflective from 100% down to 50%. Now the levels of both types of reflections seem to be convenient, but I still find my reflection map too visible.

3. So **one tip is eventually to transfer a part of the energy from the reflection map into the ambient.** For this DO NOT touch the "set more reflective" dial, which would also reduce the ray trace contribution. The only thing you have to do is to go on "Uved strength on reflection Map 1" and go for a darker level of grey. I set it down from (202, 202, 202) to (160,160,160) and transfer the energy to ambient by setting ambient from (0,0,0) colour with 25 % strength up to (139,135,107) with a 35% strength.

Personally I'm satisfied by the balance. Yet sometimes it can be difficult to reach a nice compromise depending on your initial object characteristics. There is one more trick which I wanted to mention then :

4. Difficult to find the right balance? Then add and dial displacement!

I load one of the displacement map. The ones I would advice for this specific purpose are the numbers 3, 8 and 26 one of MR displacement presets. Double click on the preset to load it, and then adjust the strength to somewhere between 5% and 25%. Here I use displacement preset 3 with 20% strength for instance.

Why is it working? Because the displacement will "blur" or "break" your reflections, mapped or ray. **And this will somehow "mix" better your environment mapped and rays reflections, blurring the transition between the real reflected space (rays) and the fake reflected one (mapped).**

5. Now you can go for the "final touches". First adding displacement will have very probably decreased the global output power. So you can this time re-increase set more reflective (from 50 up to 70%). You can do this because of your displacements. If you want to have more precise ray trace images, you can either increase ray trace contribution, but what can be smarter this time is to increase "ray strength" directly in the dials. Why smarter? This will avoid to change the balance of the reflection versus ambient by dialling rays up (and as a consequence map1 down). This is a way to increase rays ONLY keeping all other settings constant (remember increasing ray decreases map 1 power, this is in the calculus).

Now the "ray strength" limit is set to 1, but we all know that limits can be removed.

So remove this limit a force a bit "ray strength".

Illustration : First reflection settings in 4 steps (detailed on the previous page)

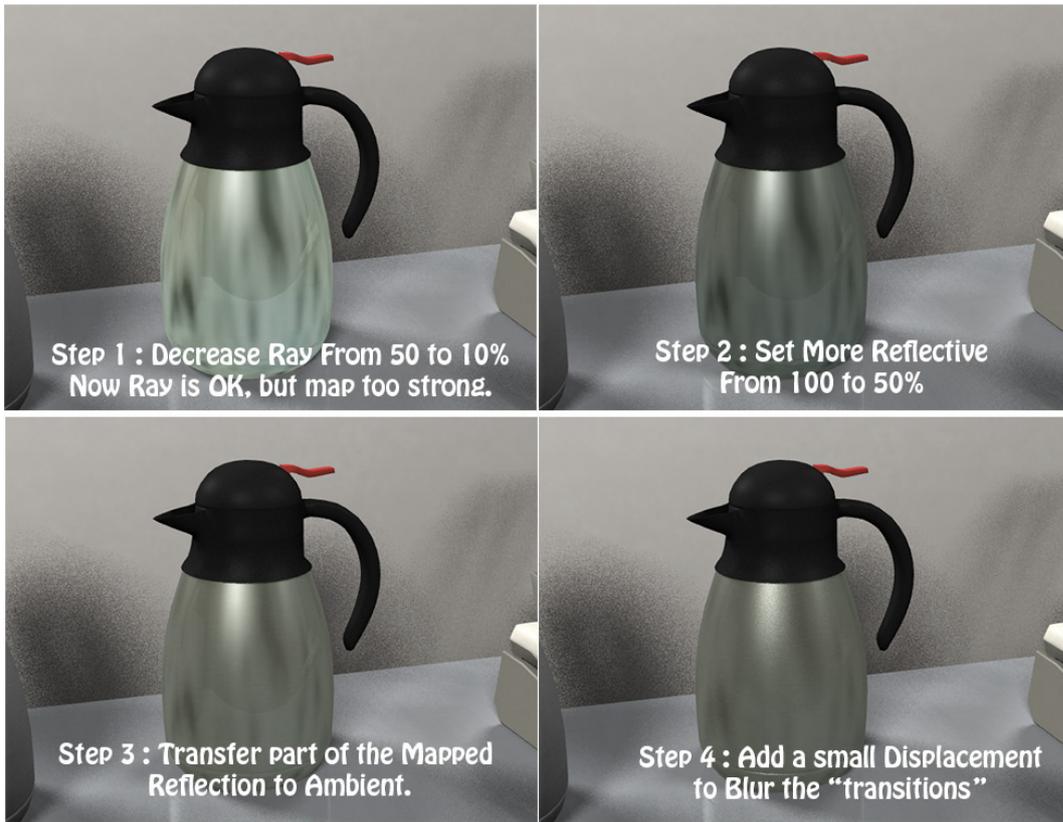
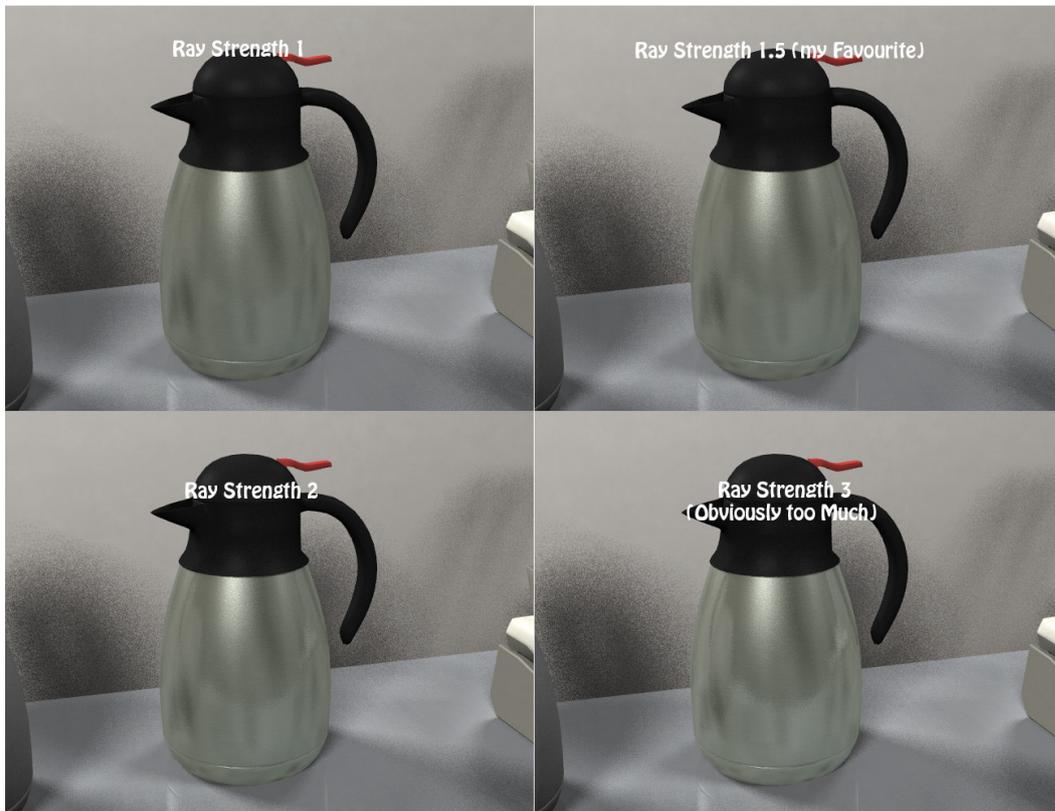


Illustration : Ray Strength influence, all other parameters constant



This concludes this part concerning Reflection for Metal 2.

3.3 Influence of Surface Deformation Components Metal 1 and 2

For BOTH metals, the surface finish are a very important parameter.

First a little introduction concerning material recognition.

What does make people say "this is a metal"?

The fact that its brain recognises and categorise it as metal. Nothing more.

Now the job is to have the human user brain believe this is a metal.

How? First the category of object also depend of the object shape. If you take a T-Shirt, and make it metallic, it will be hard for your brain to believe that, because "T-Shirt" and "fabric" belong to the same brain association. It will work much better for robots or cars.

Now what, except the shape and the overall specular and reflection, the parameters which matter?

I would strongly recommend the reading on this article :

<http://www.sciencedirect.com/science/article/pii/S0042698913002782>

I quote a very interesting article here (Vision Research, Volume 94, January 2014, Pages 62–75, "Visual perception of materials and their properties", Roland W. Fleming1) :

"This simple insight leads to a key hypothesis about gloss perception: when subjects are asked to report the apparent glossiness of a surface, it could be that their judgments reflect the extent to which the surface manifests salient specular reflections. Put another way, it could be that subjects use the characteristics of the reflections—their size, contrast, distinctness, etc.—as a 'proxy' for estimating the intrinsic physical surface parameters, such as specular reflectance. This makes intuitive sense as reflections and highlights are the defining visual characteristic of glossy surfaces. While surface reflectance properties are not visible directly, highlights and reflections—as the primary manifestations of specular reflection in the image—are visible directly, and have properties that can be measured relatively easily by low- and mid-level visual hardware. Glossier surfaces manifest more salient specular reflections than less glossy ones, and thus it makes intuitive sense for the visual system to attach special import to the size, contrast and distinctness of specular highlights as a way of characterizing surface gloss."

....

Even in this article only surface gloss is mentioned, the idea is the same for metal recognition. That's approximately going to do use with the Surface Deformation Components

They are divided in 5 levels for the Metals with suffix FULL, in 4 for the other one.

The five levels are : 1 for bump, 3 for displacement (2 only for the not full version), 1 for normal.

3.3.a Bump

Bump generally supports low surfaces deformations and often corresponds to the underlying patterns. Yet I decided to allow bump to have a separate tile to for people who would like to use it as one more deformation linked only to material defects.

Most of Content Creators being very familiar with Bump mapping, I will not go further on the subject.

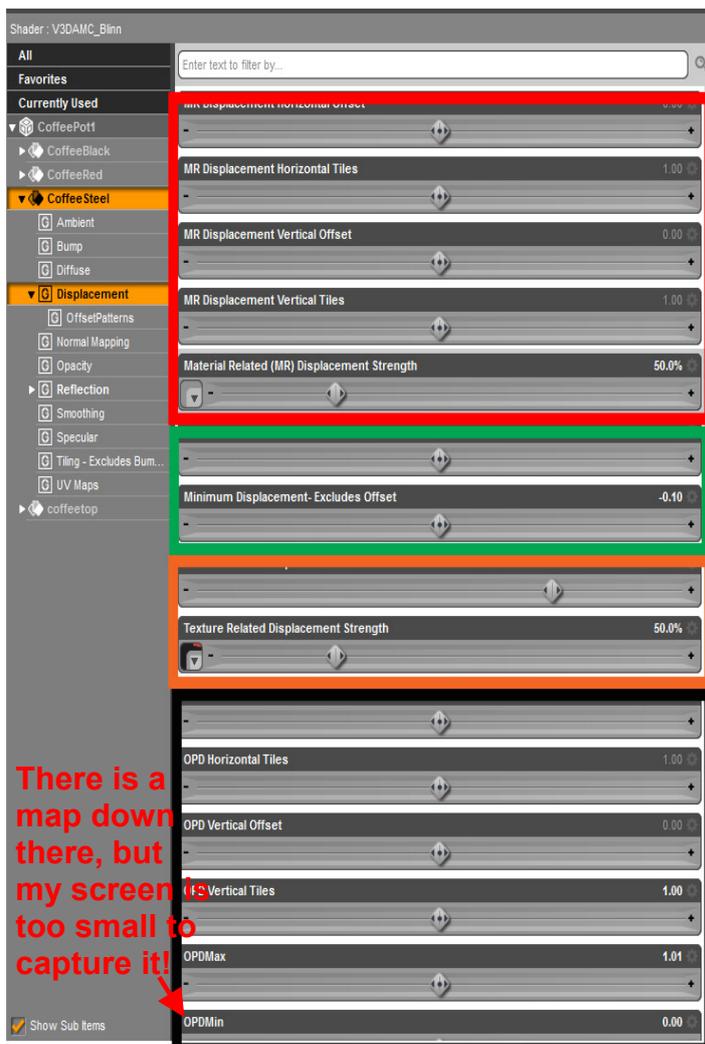
3.3.b Displacements

Displacements part of the materials are the ones which present the major differences regarding the DAZ default material.

There are now 3 Displacement maps, which are going to be detailed in the next pages.

- First one is used to enhance the diffuse, or "colour" aspect. If you show scratches on your material, then it is better to have scratches as displaced surfaces.
- Second one is used to add independent surface defects (scratches, digs, fractures, edge chips, pitting, dirt, abrasion.....) It is interesting to vary the scale effects of these defects, that is why independent tiles are required.
- The last one is there for the usual way DAZ content creator often use the displacement maps : in order to add a pattern with a relief on a mesh. This one has also independent tile, which is not usual, but I thought it might be interesting anyway. You will also find it in /Displacement but for more comfort of use, it has a specific subcategory : /Displacement/Offset Patterns.

Now here is what you see when you open the displacement of the material in the surface editor.



This Map is dedicated To Surface Finish Defects with Tiles Separated From the rest. Called "Material Related Displacement", or MR Only.

This drives the two displacement (MR and Texture) Min and Max contribution together. You can swithc the Sign of Min and Max to Invert direction.

This Map is dedicated To Surface Finish Defects corresponding to Diffuse Colours and share Diffuse Tiles. This is the "Texture Related Displacement"

This is for the "Usual" use of displacement, consisting in applying a Pattern rising up (or the contrary) from the surface. Everything (tile, min, max) is independent from the rest.

You find it under /Displacement or /Displacement/OffsetPatterns You will find a better view of it in the Corresponding Displacement Part of the Document.

There is a map down there, but my screen is too small to capture it!

A detailed view of the OPD (pattern displacement) part can be seen in the corresponding part further in this document.

3.3.b.1 Texture related Displacement

This is the only surface deformation component for which the tile is linked to the general tile of colour components. This is dedicated to enhance the linked to the colours and patterns of your materials. **It does not work exactly as you are used to, they do influence the displaced points but not on the final levels, only on intermediate levels.** Sometimes you may not notice strong difference in comparison with what you're used to have, sometimes the difference become more obvious, since **it does not allow strong displaced like "offset" points, as a consequence are not convenient to displace decorative patterns on metals.**

Well the coffee pot is maybe not well chosen to show texture related displacement since it does not present strong variations on diffuse map.

Yet, the base diffuse of the coffee pots presents some white stripes as shown of the following image :



Now this stripes are the "fake result" reported on the coffee pot diffuse of some supposed material defects. These surface defects can be also applied on the texture related displacement map, so that they give the impression that there are some highlights.

The main advantage of including them on the displacement map rather than on the color components only is that they react to light.

The main drawback is sometimes difficult to create the right displacement maps.

The second drawback is that, as usually, the final effect depend on the camera distance.

Here the comparison of two renders, first on the left all Surface Deformation components Off, then on the right I include the diffuse map in the texture related displacement, with an exaggerated strength so that is well visible on this document renders (normally I should have created the corresponding displacement map, but this is just to show the principle).



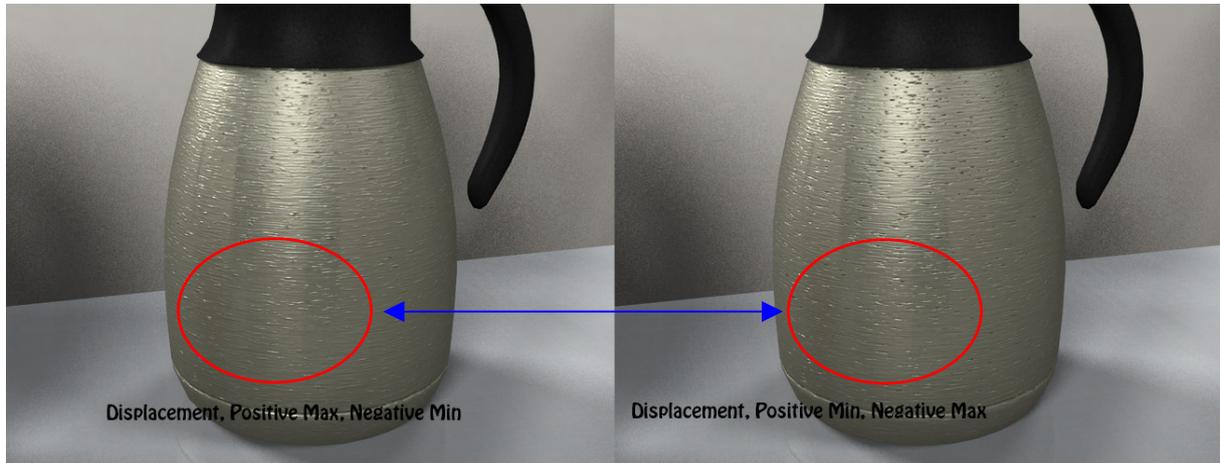
Minimum and Maximum Sign Switch :

As shown in the following images, the orientation of displacement changes when you switch from a positive max displacement to a negative one, and inversely for the min displacement. This allows you to revert the influence of displacement maps.

WHAT IS IMPORTANT TO REMEMBER CONCERNING SIGN SWITCH :

As I just mentioned, switching the signs of the displacement min and max allows to inverse the direction of displacement.

There is yet a constraint : these min and max influence BOTH texture related displacement and material related displacement. As a consequence, you have to create your maps in order to take into account the fact they share this common influence.



Then remember, the easy solution to correct the orientation of one of your displacement map only is also to invert in photoshop the image colour, (and eventually adjust the grey levels) and use the inverted map in DAZ Studio.

3.3.b.2 Material related Displacement

This additional feature is here to allow you to add surface defects independent from all the rest.

You may consider that you have also this feature available in the normal map, but normal maps tend to produce smoother surface deformation, making rough variations is sometimes more difficult to obtain, and furthermore you may want to keep your normal map in order to add other details to your model, the way you usually do it.

What is important with material related displacement?

Depending on the type of image map you use, this is going to modify your highlights and reflections. You can change this way "mirror" metals to become rough ones, but not by using any of the other parameters of material. Just by using this map. And this is because, the calculated reflections will be, at each point of the calculus, influenced by the displacement map.

Well these displacement maps for metals will have somehow the same influence on the environment reflections.

That is why you can use MR Displacement several way :

- where you will have very clear and distinct patterns on your map, then you will add visible clear and distinct defects on your surface.

- where you will have a kind of diffuse noise on your map, then you will add a kind of roughness to your materials. This last point may be harder to understand. A good comparison in term of "breaking the image" is the one the glass types used in showers so that you don't clearly see what's in the shower. They are the same glasses as the fully transparent ones. The difference is just that the surface includes enough defects to modify enough the path of light beams so that the image is "broken".

Of course you can have map supporting both of these different effects, or you can also for instance increase so much the tile of a map with that it will then present a contribution for global roughness.

Please note that at the difference of the specular roughness which is "pre-integrated" in the material via a formula, the roughness obtained with maps is calculated directly during the render.

The best thing now is to add a few images and comment them.

On this one, I kept the same settings for all material except the tile of the MR Displacement Map. We get the feeling that the image is not the same, but it is.

In this example, I used a map and parameters allowing the metal to maintain its "mirror" properties.



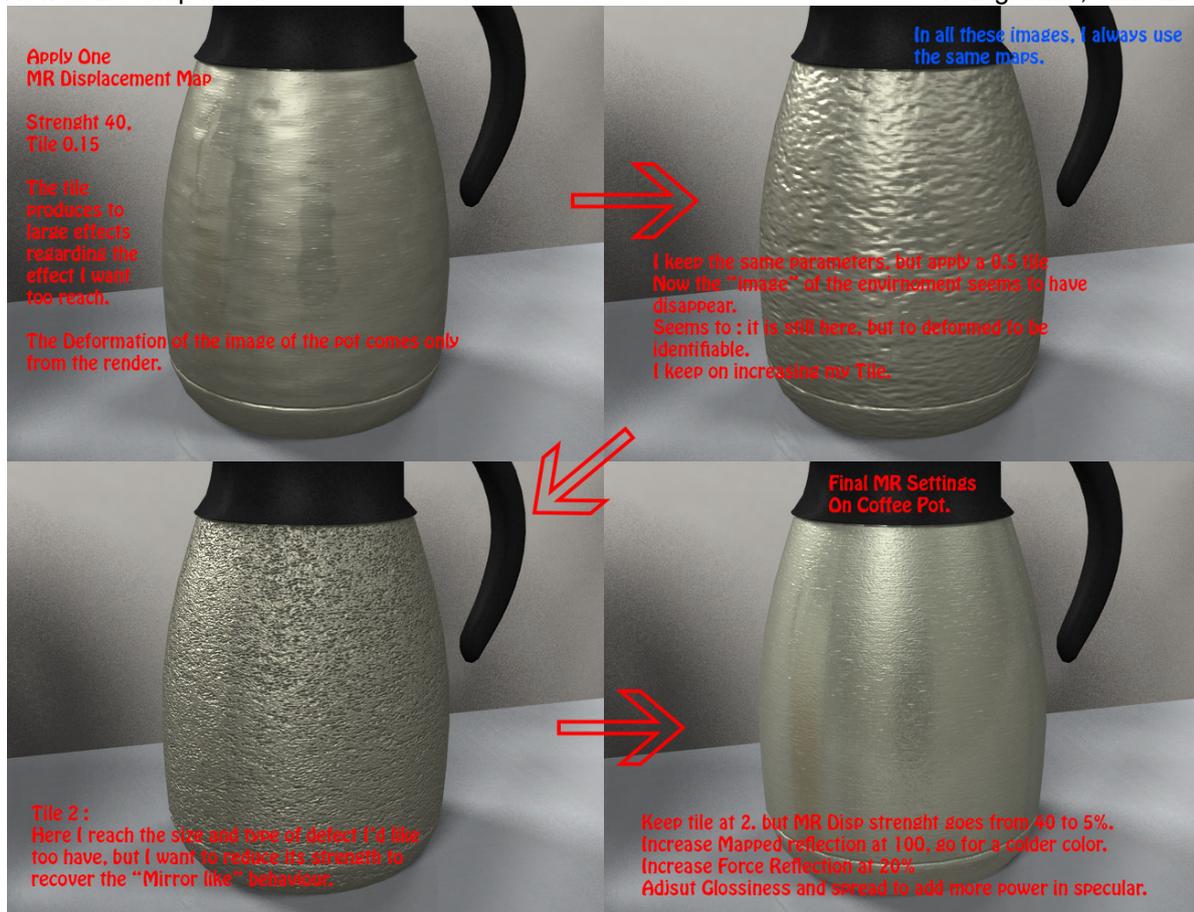
Now let's try another map and adjust the effect of it, then the other parameters.

In the example next page, I load one of my map, and then modify the tile only of it in order to reach the size and repartition of additional defects that I want to obtain on the metal. I decide to reach something close to an uniformly distributed noise.

Once my tile is defined, I then have two choices :

If I want to keep the "mirror" effects on the metal, I lower the strength of the MR displacement. This is enough, but I also readjusted the secular and reflection in order to optimise the new material with these displacement settings.

Just have a look at the following "optimisation" steps.



Well one point which is not mentioned up there and which is :

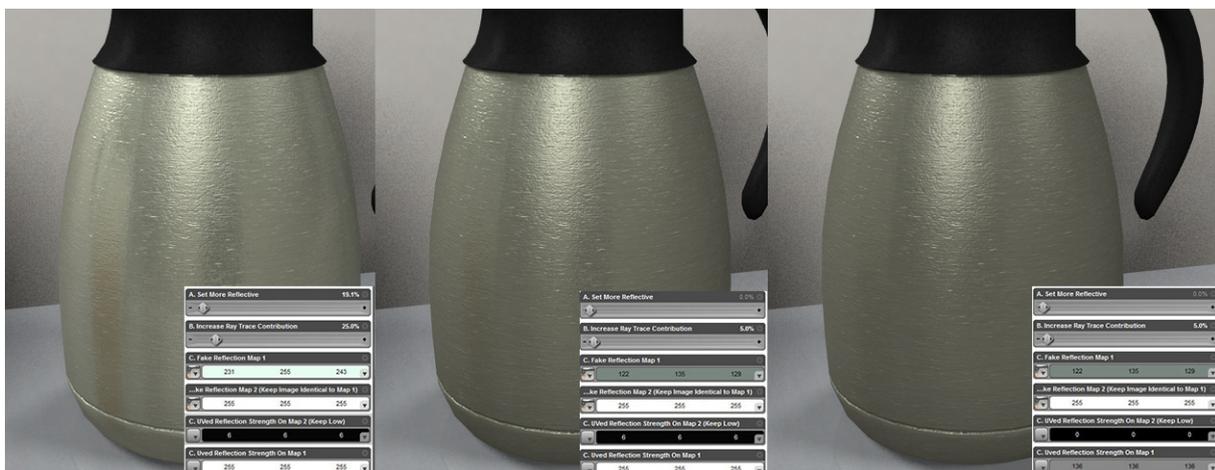
What if you don't want to keep the "mirror" effect, but that you find that the displacement required to avoid this effect (as the one of the third example on the image above) is really too strong? (which is true!)

The solution is simple :

Lower everything linked to your reflections. Go in the Reflection tab of the surface where you can :

- First lower the ray trace contribution : if you want. This will concern rays only.
- Second lower "Set More Reflective". This will concern every reflection types.
- Third lower "Uved Reflection Strength on Map 1", this will concern only the map base reflection.
- Finally you can also change for a darker colour in the "Fake Reflection Map 1".

Now see the difference :



I just want to add a tip here : you may still see a bit of the environment, even with the lower settings, depending on your specular settings. One thing you have to know is that somehow a part of the reflection is visible because of the specular properties (for metal 1). If you want to totally remove an environment map, the best solution is to remove the map completely. If you want just to lower the strength you can do this both by darkening the Uved Strength (map 1) dial of by darkening the colour applied to the reflection map 1.

3.3.b.3. Offset Patterns Displacements

3.3.b.3.1. General Remark

During all the initial development stages of these shaders, the results in term of metal rendering were better if the displacements were not directly apply to the final displacement input of the shader, but more in intermediate bricks. **That is why the two previous displacement types, the maps act in a similar way as displacements do in term of local effects, but with huge limitation concerning the height of the displaced full pattern available.**

This was not a constraint for instance in the old "Advanced Metal Shaders" product, since they did not require this feature, **but it was important to include it in a merchant resource so that content creators used to add displacement to create additional patterns on their assets could be able to do it.**

That is why Offset Patterns Displacements have been included in the merchant resource version.

Now they almost rely on the same brick as usually, just keep in mind there is several underlying displacement and bump effects before this displacement. They act in a very similar way regarding what you are used to do with them. When I tested this new Pattern Displacement Addon, I used a large panel of situations, I understood that the only important warning in using it was the offset of surfaces which could appear without any map on it. This is why I had to create a parameter to "kill" this offset linked to displacement when there was no map.

Important point too : just like all displacement, their visual influence depends upon the camera distance. So think that, depending on your object types and scale, the camera of the user may tend to be more or less far or close, and adjust your displacement strengths taking these elements into account : OPD Strength, being 0 by default. Remember to set it at 1 when applying a map.

3.3.b.3.2 How to apply The Pattern

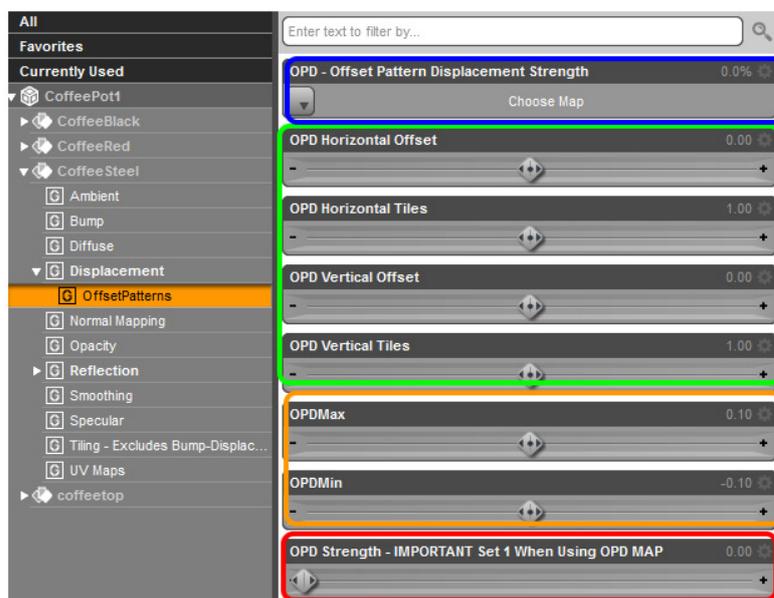
Here I decided to add the DAZ logo in order to make a "DAZ Coffee Pot". I just placed it on the right place UV map of the Coffee Pot.

What you have to know is that :

- White areas on your image contribute to positive displacement, Dark areas to negative ones. Keep all the other points to the neutral Grey.

- Keep Min and Max exact opposite the one from the other so that no global surface offset appears!

- **PLEASE SET A 0% displacement strength if you have no map plugged. Otherwise offset will appear too** : you may see your object grow bigger or smaller. So if you don't use the pattern map, let the strength at 0.
- **By default BOTH map strength and OPD displacement strength, called "OPD strength" are at 0. Those two parameters multiply each other for the final displacement. Whenever you plug a map, set OPD Strength at 1, and adjust the strength of your map as usually.** These parameters have been set to 0 so that if you don't use "pattern displacement maps" you will do not suffer from eventual offsets linked to these displacement. For the map, levels higher than 100% are accessible, but their use may lead to the production of artefacts. Concerning these specific displacement maps, you will find all your inputs in the surface editor using "Displacement/OffsetPatterns", or directly using "Displacement". Let's have a closer look :



Usual Map Driver,
Better set 0%
if no Map

Independent Tiles and
Offsets
Of the Pattern

No Map : Try To Keep
Min And Max Opposite
Min = - Max,
Map : Adjust Min and Max
Regarding your needs.

**STRENGTH OF THE
TOTAL DISPLACEMENT**

IMPORTANT : Strength of the Total Displacement is by default Initially 0.
Set it at 1 as soon as you use a map.
You can also remove the limit and set
it much higher for very large displacements!

IMPORTANT : The map displacement strength may also be 0.
Adjust it as you are used to when you use a map,
but : Set it back to zero if you remove your map.

How to obtain more or less strong Pattern Displacements?

- First by maps level of black, grey and or white, but this you already know.
- Second by the limits min and max you apply. As usually, try to keep max = - min if you want to avoid offset, but this also depends on the map and effect you want to apply.
- Third by increasing the Map strength,
- and Finally : by changing the parameter called "OPD Strength". It loads with a default 0 value, in order to avoid surface offsets. So as soon as you add a map, set it at 1. By default, I also set the limit to 1. Yet, if you want stronger displaced patterns on your objects, just remove this limit and raise you OPD Strength (red part of the

above image) up to... whatever you need. It is generally better in term of result than increasing the map strength itself above 100%.



3.3.c. Normal maps and further adjustments

You can use them as you usually do, in order to add mesh details, or the pure "material" way, to add - generally smooth - surface deformations on the material.

They differ a bit in term of displaced normal total amplitude, which is a consequence of the method I used so that they are drivable and revertible term of strength, but their behaviour remain the one of a normal map.

In order to illustrate the "add mesh details" function, I just created very rapidly the normal map of DAZ logo, so the result is not optimal, but here is what you have for a few settings of normal strength.



Normal Map strength variation is not absolutely linear since in order to obtain a controllable map in term of strength, it is mixed with a "zero Normal map" with a strength for the mix dependent on the strength of the map. So effects are the result of this mixing, briefly speaking, tending to alter the initial normal map strength and colour contrast.

Now in order to illustrate the second way of using normal map, it can also be added to the material in order to add defects, just like it is the case for Texture or Material related displacement, but it will in general contribute to a smoother type of surface deformation. Many Presets are included in the product, but you can easily create your own presets.

The following image shows that you can easily change the look of your metals by varying normal maps, of course, but also strengths and tiles applied to them.



Now What you will probably immediately see it that the coffee pot seems less shiny with the normal maps applied? It is the case. This for two reasons, first one the environment reflected map is "broken" even more by the pattern. But the second important reason that the deformation of the surface implies self shadowing of your object. The deformations of your object adds shadows on your object and so remove energy from it. You can compensate that by : Increasing Ambient or Reflection (depending on your initial settings and preferences), and increasing Specular highlights too.

In a first step : I raise ambient from 40 up to 60%

In a second step : the mapped reflection is already at max. Now I have two things to take into consideration. First the coffee pot has become so "bumpy" than the ray traced reflection upon it are not recognisable any more. They can be eventually removed. Then I want to increase the mapped reflection. The strength of the max already being at max, I raise the "Set more reflective" from 20 up to 40%. Finally, I would like to increase the specular but it is already at 100%. Then two choices again : remove the 100% limit and increase the specular strength above 100% (you have the right to do so). Or give more surface coverage to your highlight by reducing glossiness and or increasing the spread. I will increase the Spread from 0.14 up to 0.4, and reduce the glossiness from 75 down to 70. If it was on metal 2, the "Larger" dials would just have to be increased.

The successive results are shown in the following image, this is just an example of the different contributions influences, other settings may suit better your own objects.



3.4 Opacity Management :

Opacity is a particular case of figure.

- As long as you do not plan to use opacity, keep the initial appliers and initial full presets.

- **If you plan to use opacity, here is what happens :**

Case1 : If you apply the opacity map, as usually, without increase reflection conditions above the usual limits ("Set More Reflective" at 0), then you will see no difference in term of render.

In term of interface, you just have to note that opacity strength is driven by black and white colour instead of a 0% 100% dial, which does not change anything for you. You just have to remember that a full black colour is 0% and a full white a 100%, all the rest.

The fact of being colour driven by opacity allows to make a "partial coloured transparent material". Just try to use a different colour as opacity strength. I let it this way in order for you to be able to play with it for some "special effects" not necessarily metal ones.

Just look at the images and imagining what special effects you could have with it... I'm sure plenty of you will have ideas (and this is unmapped !)



Case 2 : If you increase the reflection conditions above the usual limits, by using a positive "Set More Reflective", then the transparent part of the surface will still show the reflection component (and only it). The higher you set the parameter, the most visible the effect.

In order to correct this, I have included two "patches", one per metal type. They are located in the "09 opacity management" folder. Once you have applied and set up one of your metals, just select your surface and double click on the corresponding "patch" file. **Note that only the way opacity is handled will change, all your other settings will be kept identical**, you do not lose your other settings. **You will just have to re-dial your opacity strength.**

The solution consisted in multiplying the final component by the opacity map before re-injecting it in the final colour. This allows to apply FULL transparency also where the reflection contribution was initially too strong. You also come back to the usual opacity driver with only a 0% 100% variation. This is a kind of "multiply reflection through opacity".

4. Additional Tips

What if strange artefacts appear?

Sometimes if you force several reflection parameters really too high, you can see strange coloured dots appearing where there is a lot of light reflecting on your object. This is due to the fact that you have gone really to far above physical results and then you have to reduce either ambient, or reflection, or specular, or all of them in proportion. This is the famous "energy conservation" aspect of them.

Removing Reflection Maps Tip :

Removing your reflection maps will allow you to reflect your surrounding props. But in this case you loose all the interest of the reflection map which is simulating the presence of a fake environment around your object.

Pure Addition Ray Trace Mixing Tip :

Concerning the reflection part, the shader is built this way.

You add map 1 to map 2, with a strength going from 100% down to 0%. The strength of this addition is driven by the "ray tracing contribution" so that when you increase rays from 0 to 100, the map1 addition to map2 decreases from 100% down to 0%.

Now you can for instance totally remove this influence and go for a simple "addition" of map and rays contribution. This is easy : set map1 strength (Uved Reflection Strength on map 1) to 0 (black colour (0,0,0)). And now you can increase

With these conditions, the output of the reflection then becomes the exact addition of map 2 reflection with ray tracing (Map 2 strength is driven by Uved Reflection Strength on map 2). The result of this addition keeping the exact proportions of it can then be increased by "Set more reflective" dial.

Remember, the "keep low" of Uved Reflection Strength on map 2 becomes useless if you go for this option, since it is then map2 which will give you the strongest contribution for environment map based reflection.

Maps Images and Colors influences on Strengths :

Briefly speaking, remember that for "mapped" setting the final result is the multiplication on each UV point of the colour of the map, times the colour the map relies on (in the surface tabs), times the strength you give to the map. So even if you have 100% strength, if the rest is null, you will have a "black" result. The final strength and colour of a parameter applied to a surface takes into account all this.

Shapes influence and flat objects particular case :

During the renders, the shape of the object is a key parameter. Why? this is because most of the calculus are based on the laws of reflection, meaning that reflection angle is the symmetric of incident angle regarding the normal line (surface geometrical normal were incident beam hits the surface). With BRDR, this is a little bit modified by a formula, but the basic principle is here. This is all a matter of angles.

The geometric variation of reflected light will depend on the angular variation of incoming light and/or the one of the object.

Infinite lights have a constant angular energy repartition. Points lights do not.

Yet since you are a content creator, you cannot guess what type of light your users will chose. Then you have to anticipate this.

On curvy objects, the geometry of your shapes will do "all the job" for you, since the angular variation is included withing this geometry.

On flat objects, this is more difficult, especially if you consider that most of the users use only infinite lights. The best solution you have is then to create yourself all the highlights which will give a metallic aspect. Since it cannot rely on object initial geometry nor on light angular repartition, the best solution is to add enough surface defects so that they provide small highlights.

This is also why a setting of parameters you build for a purely flat shape will not correspond to the settings of a very curvy object.

What if using Rough and Polised Metal Presets, the Highlights become too Strong?

The reflection presets of the metals (folder 2 and 3) have been designed to cover an "average" setting of all other material parameters (ambient, diffuse...colors, maps and strenght). Applying one of the preset can lead to really too strong highlights. For metal1, you have to reduce BOTH strength of reflection (Map1) and of Specular. For both components (specular and reflection) you can also darken the color applied on the maps. For metal 2, reducing specular strength should be sufficient.

Help Me! What if surfaces offsets appear ?

Well first thing to know is that this problem is common to most of the material using displacements (displaced points) out of the shader mixer. Even if I took great care to avoid, this, this may happen under certain circumstances. There are solutions.

Whatever your problems always begin to try add apply max displacement = - min displacement.

In these materials, the displacement of surface points are linked to 3 displacements : Texture related displacements, Material related displacements, a OPD (pattern) Displacements.

The way these shaders are configured, Texture related and Material displacement should be responsible for only very small amplitude of displaced points, making it much less probable that the problem come from them. Only OPD displacements are allowed for large offsets since it is their main functions. This is probably where you will find the solution to this issue.

This may be due to two points :

- You have no map in OPD displacement, and yet your total strength of it "OPD Strength" (unmapped parameter) is not null. Set OPD Strength to 0, and eventually set back OPDMin= - OPDMax (or both equal to 0). This should solve the problem.
- You have a map in OPD displacement, and of course, you see the displaced pattern on your surface, but your surface tend to "offset" globally. **Then you have to adjust your respective OPDmin and OPDmax dials.** Briefly explaining indicate from which negative offset (influenced by the map) to which positive one (map dependent too) they will "offset" the surface. It depends amongst other things on the way you built your map, on its base grey level.

Now, if all these conditions above are respected, the second most probable origin of it is the MR displacement. When the Map is left empty, it can induce small offsets.

The solution is easy :

1. If you use neither texture related displacement nor Material related displacement maps, the solution is **SET " Minimum Displacement- Excludes Offset" AND "Maximum Displacement- Excludes Offset" BOTH at 0.**
2. If you use a texture related displacement Map, but no Material related displacement Map, then there is a problem because Texture related displacement need a Material Related displacement to work on. Normally, appliers and presets include a map. If you removed this map from the MR displacement by accident, then just load from the runtime the map called " DispPatchKeepMeIfNoOtherMap.jpg".

Help Me! I cannot see the displacements!

If you cannot see the displacement you use in the OPD map, check first that the strength applied on your map is 100%, or strong enough depending on the map you use.

Once done, check that the parameter "OPD Strength" (not the one on the map, the other one allowed to vary from 0 to 1) is set at 1. This is not the case by default, and this in order to avoid offsets linked to empty map slots.

If you cannot see the displacement you are using in Texture related displacement, just check : first that the "Texture related displacement contribution" dial is high enough (not 0 at least), and that the strength applied to the map is not 0 too. If it is the case, check now that you have a map in the MR displacement. If you have no map, place "DispPatchKeepMelfNoOtherMap.jpg", included in the Runtime. You can even if you want use the TR displacement map in the MR displacement map slot, but then just remember that the tile of this latest contribution must match the general tile.

In general, check that in all cases,

- The Strength applied to your maps.
- The additional dials are not null (1 OPD Strength and at least 0.3 for Texture Related Displacement Contribution")
- The Amplitude (Min and Max) of your displacements are not null. (Min must at least differ from Max).

What if, with ray tracing, I cannot see other props in the scene?

This may happen and has different independent origins :

1. Check that your ray depth in render is 2 at least.

2. Check your object shape and surrounding objects versus cameras alignment :

In order to see a real reflect object on your own prop, you have first to respect the rules of reflection, meaning that the camera must be aligned with the reflected image of the object .This is not linked to the shaders, this is only linked to the physics of reflection and calculus made by the render (almost independently from the shader).

If you want to be SURE it comes from that, you can either move your cameras or your surrounding props around your own props to find the right alignment, but it might take a while to check that, or to go fast, you can just test your shader ON A PLANE.

Using a plane will help you to get rid of a large part of the alignment problem. If is working on a plane, your impression of "no ray tracing" was just coming from the fact that your "test surrounding props" were not well placed regarding your object shapes and camera.

Also check that there are enough lights on surrounding elements to be visible on your prop.

3. It can come from "to much" surface deformation. Surface deformations, included in displacements and normal maps, have several consequences : first they will provide the small highlights distribution making a metal looking like a metal. But they will tend to "break" the image of the environment, mapped and/or ray traced. If you want to check if it comes from that or not, lower all displacement, eventually to zero, just to confirm the origin of the issue.

5. Video Demonstrations

You will find several hours of complete video documentation linked to this product.

You just have to click on the following images in order to open YouTube Videos :

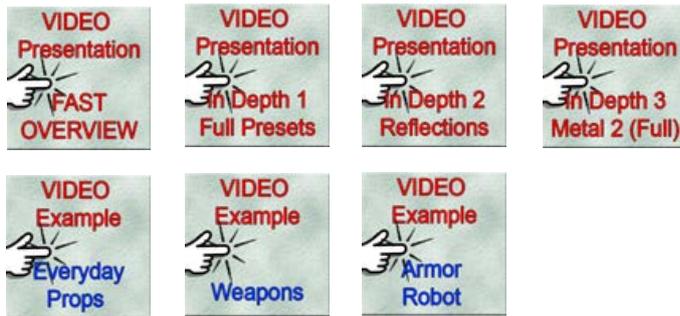
A rapid overview of the product,

A complete overview of the product,

Example of material set-up on everyday props

Example of material set-up on various weapons

Example of material set-up on armour and robot



Older links :

For the ones who are more curious, you can also find videos I made for the "Advanced Metal Shaders". Even if the shaders have been widely reworked and enhanced, the base principles remain the same as for metal 1.

More information on the metal reflections on this thread of DAZ forum :

<http://www.daz3d.com/forums/viewthread/41437/>

Video Metal Shaders Several Presentations :

- The very short version (3 minutes) :

<http://youtu.be/glVI4Dx5cPc>

- The long version (a bit more than one hour) : <http://youtu.be/b6Kit810zys>

- The "apply only version" (15 minutes for the ones who only want to apply the "base" (and not the full presets) on the shader on existing objects, keeping their main maps).

<http://youtu.be/A3NuHSsf4Yk>