Materials: Introduction

This is a short introduction to Kerkythea Material system. Kerkythea offers a flexible Material editor, capable of producing accurate Materials such as Metals, Wood, Glass, etc.
I will introduce now the most important Materials namely Plastic, Metal and Dielectric.

Materials: Plastic

Most of the time, we will use Kerkythea Matte/Phong Material to create our Materials because it contains several basic components such as Diffuse, Specular, Refraction, Translucency and Transmittance.
Let's try to make our first Plastic material. Why Plastic? Normally we try to avoid that our wood floor or ceramic has this frequent CG plastic look, so, why do I start with plastic? If you take a look around you, you will see a lot of objects that are categorized as wood, leather or some other material but they are actually very similar to plastic.
Plastic shares the physical behavior of nearly 90% of most common Materials (that's why you can buy cheap "Leather" jackets or expensive looking "Wood" furniture ;))

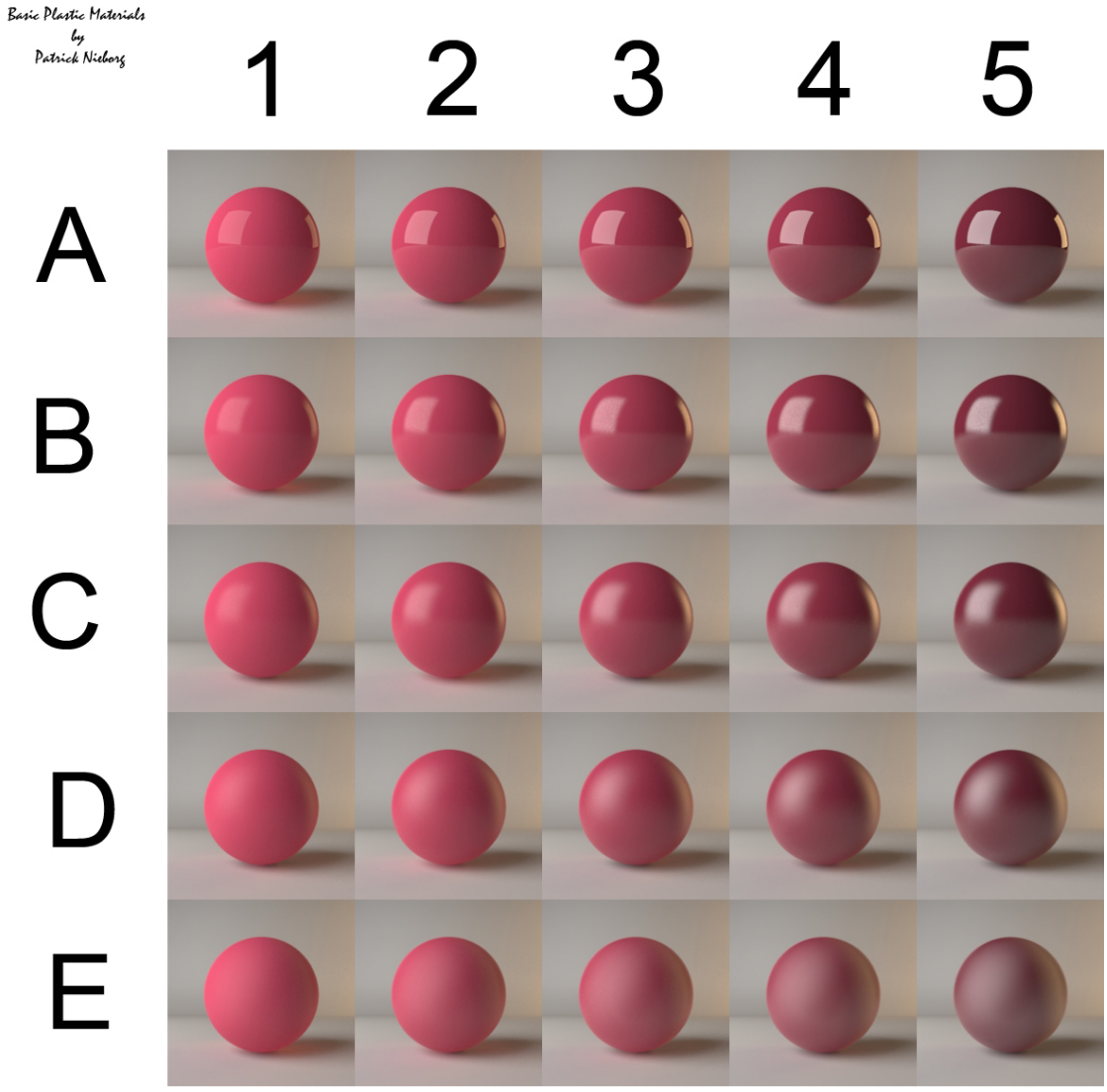


Image 01

Let's have a look at the parameters of the plastic material C3 from the Image 01, above.
Diffuse Color = 0.50
Specular Color = 0.50
Shininess = 0.50
Specular sampling is enabled with a Fresnel Specular attenuation and IOR (Index of Refraction) set to 2.00
The Diffuse component parameter controls the basic appearance of your material. The specular component controls the specular reflection color of your material and it is white in most common materials except for metals where another color can be used. Shininess gives the Material its polished/roughness feeling; increasing this value will make the material look closer to a mirror while decreasing the value will make the object look more rough (i.e. less polished).
If Specular sampling is enabled then the material will get accurate specular reflections (in the cost of increased rendering time because of the extra traced rays!) . It is important for shiny looking objects to reflect their environment. For more rough materials you can disable the specular sampling and don't lose too much realism/accuracy while speeding up the render. Fresnel attenuation is how the reflections/refractions behave on the material; most common materials have a Fresnel attenuation which makes the object more reflective when looking at grazing angle. For example, the far end of a road is quite a good specular reflector although the road material is usually considered a matte one.
The IOR (Index of Refraction) is very important and it controls the bending of the rays for objects that present some kind of refraction while implicitly affect the calculation of the Fresnel coefficient (i.e. the relative power of reflection and refraction). The most common values are between 1.5 and 5 (glass), between 5 and 8 (ceramics and metallic paint), between 10 and 20 (metals). These values are only a guide line to work with (accurate indices can be found in Optics reference tables).

Rules to follow when creating Materials

There is only one rule when creating Materials but it is very important.
The sum of diffuse and specular colors has to be lower or equal to 1. For example, the Material C3 from image 01 has diffuse color 0.50 and specular color 0.50, which makes 0.50 + 0.50 = 1.00. Now, let's pick another one, like Material B5; it has diffuse color 0.20 and specular color 0.80, that makes 0.20 + 0.80 = 1.00. You can build a material with diffuse color 0.60 and specular color 0.20 which makes 0.60 + 0.20 = 0.80; this is correct because it is lower then 1.00, but a combination like diffuse color 0.70 and specular color 0.40, is not correct because the sum exceeds the 1.00 limit (0.70 + 0.40 = 1.10). This rule applies to all Materials; also to those that use multiple materials in a layered format (Layered Materials) – in some cases you will have a diffuse color and two specular colors, for example when you use a dielectric layered material in combination with a matte/phong one and all three components have to sum up to a value lower or equal to 1.00.
What happens if you don't follow this simple rule? First, you will not get realisticly looking materials and even more, it can lead to "light burn" and other not wanted problems in your final render. An example is shown in image 02. The left ball does not follow the rule and has washed out/burned areas while the right ball follows the simple rule and looks more realistic and doesn't show the same problems as the left one. Both Balls where rendered in the same environment with identical render settings. The left Ball exceeds the 1.00 value (1.20) and the right one is in the 1.00 limit!

Image 02 washed out/burned

correct

Kerkythea Material Editor

Image 03

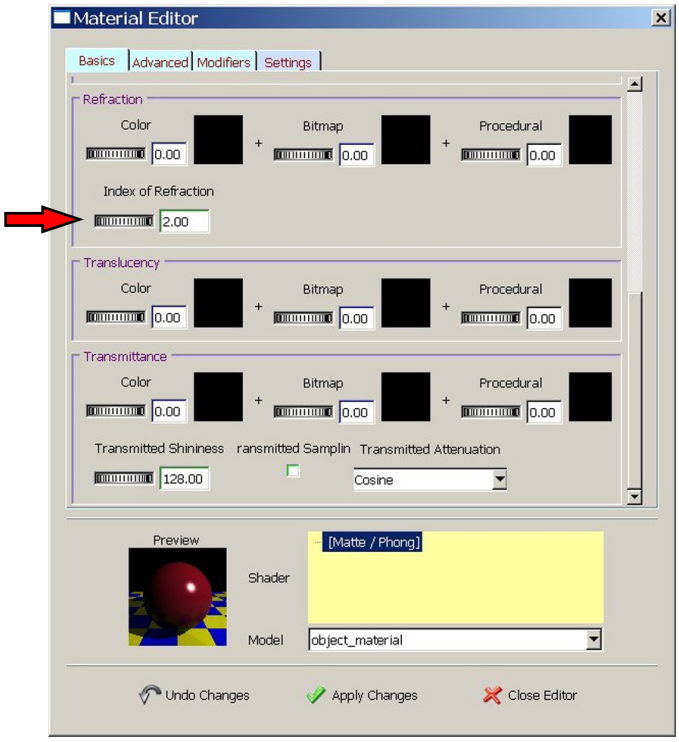


Image 04

This is the basic interface of Kerkythea Material Editor, and the settings for Material C3 are marked with red arrows. All the Materials from image 01 are obtained by changing only the Diffuse, Specular and Shininess values (remember the rule that Diffuse and Specular have to be less or equal to 1.00). Except from the first Materials A1 to A5, which are different because they have perfect reflections, I decided to use a Layered Material to speed-up render time (it is always good to optimize your Materials in terms of render time/quality; this is important when using Speculare Sampling because it will increase render time a lot and in some occasions you can turn off Specular Sampling without significant loss of render quality; for example, the Materials E1 to E5 look nearly the same where Specular Sampling is turned off and render time is decreased). Let's see how we can make a Layered Material.

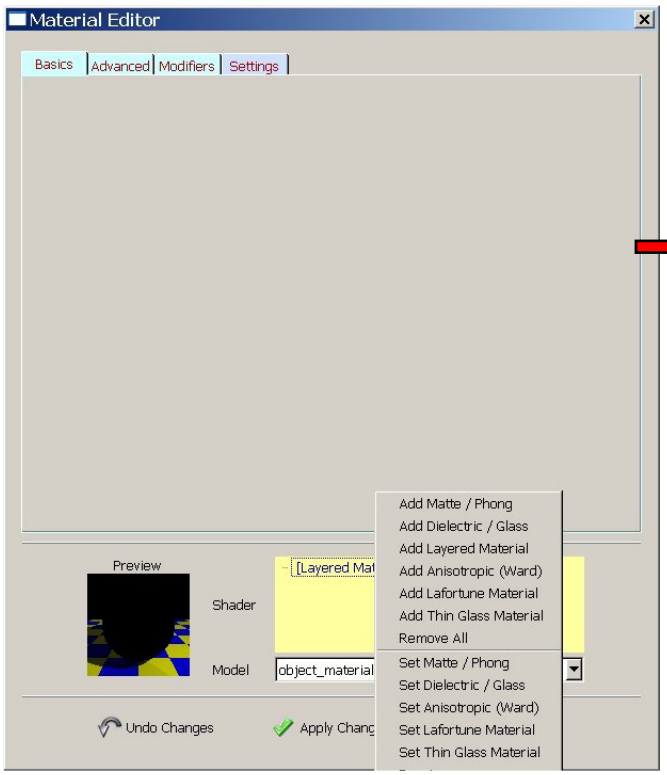


Image 05

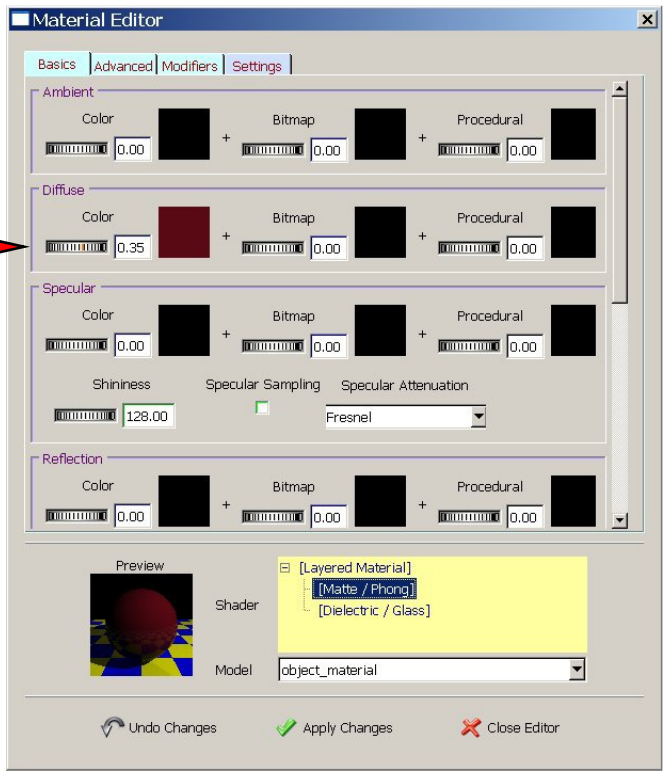


Image 06

To access Layered Materials, you have to right click on the Material name and select from the popup menu the Layered Material option as shown in image 05. Then click again with the right mouse button the Layered Material and add Matte/Phong and again right click on the Layered Material and add Dielectric/Glass Material. Now, left click the Matte/Phong Material name and adjust the values as shown in image 06. After setting the proper values for the Matt/Phong Material, left click the Dielectric/Glass Material and adjust the settings like shown in image 07. Congratulations you just made your first Layered Material. Now, let's analyze how the Layered Material affects our Material. What we are trying to achieve is a perfect shiny non-metal Material, so we need a diffuse color for our Material and a reflective Material. The Matte/Phong Material will make available the Diffuse component while the Dielectric/Glass Material will make available the reflective/refractive component of our Material. If you look at image 06 you will see that we use a value 0.35 for the diffuse color and 0.00 for the Specular color (we don't need the specular color because the dielectric/glass material will assign a proper value for perfect reflection). Also, we don't need Specular sampling and we leave IOR at 1.00 (default settings). Now, let's have a look at the Dielectric/Glass Material. This shader is normally used to produce Glass Materials but in this case we only want to use its reflective component.

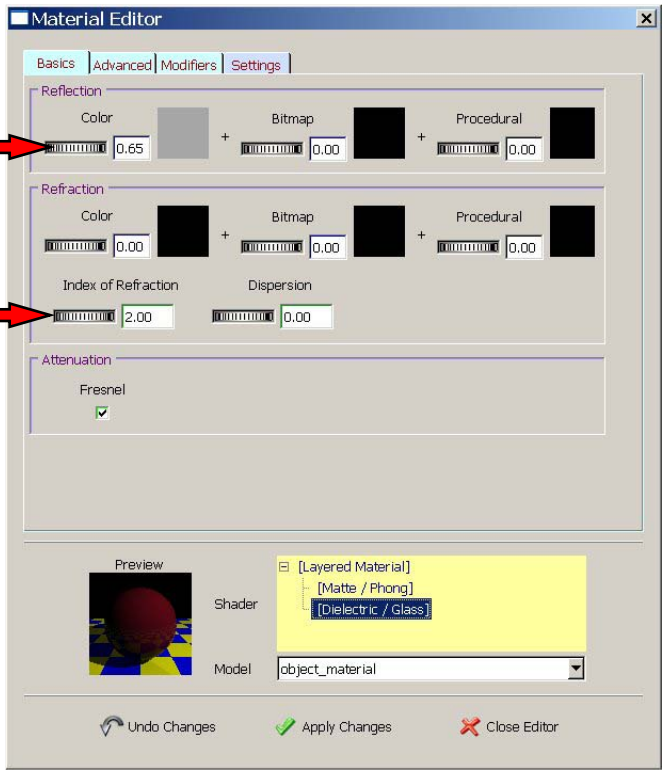
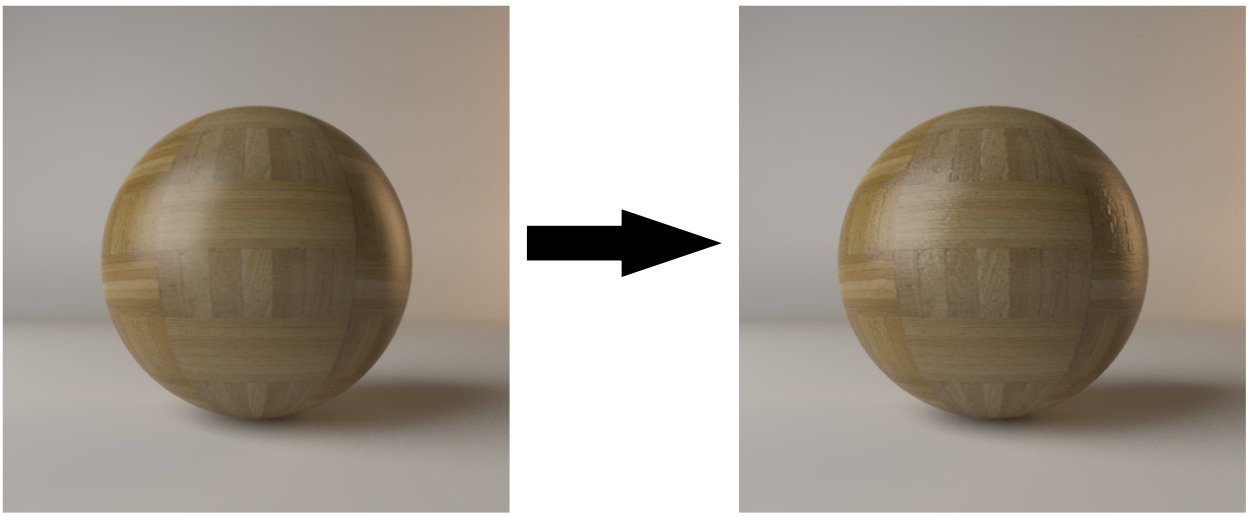


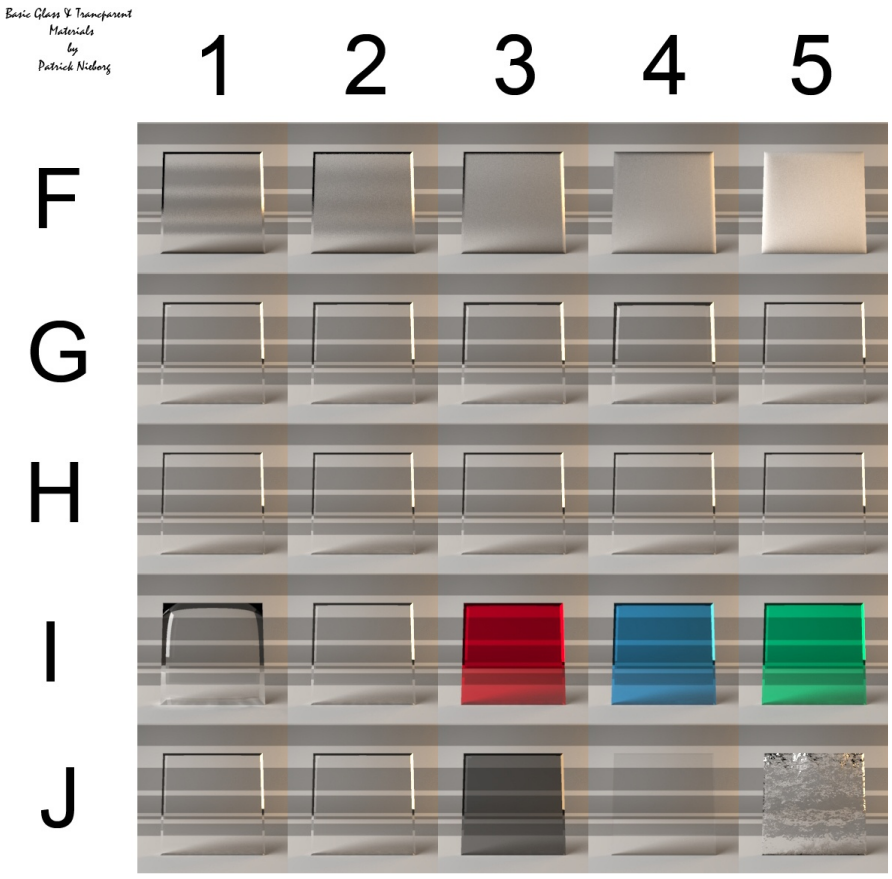
Image 07

You see that the reflection color has a value of 0.65 (remember the rule 0.35 + 0.65 = 1.00 ;)) and we don't need the refraction color (transparency) because we don't want to produce Glass; thus, leave it to 0.00. The IOR value is set to 2 which is a normal value for most Materials, a value that gives the reflection/shininess strength to our Material, and by increasing it the reflection strength is also increased. The values for common Materials are between 1.5 and 5 (glass), between 5 and 8 (ceramic and metallic paint), between 10 and 20 (metals). This is the way Material A4 was created (see image 01).

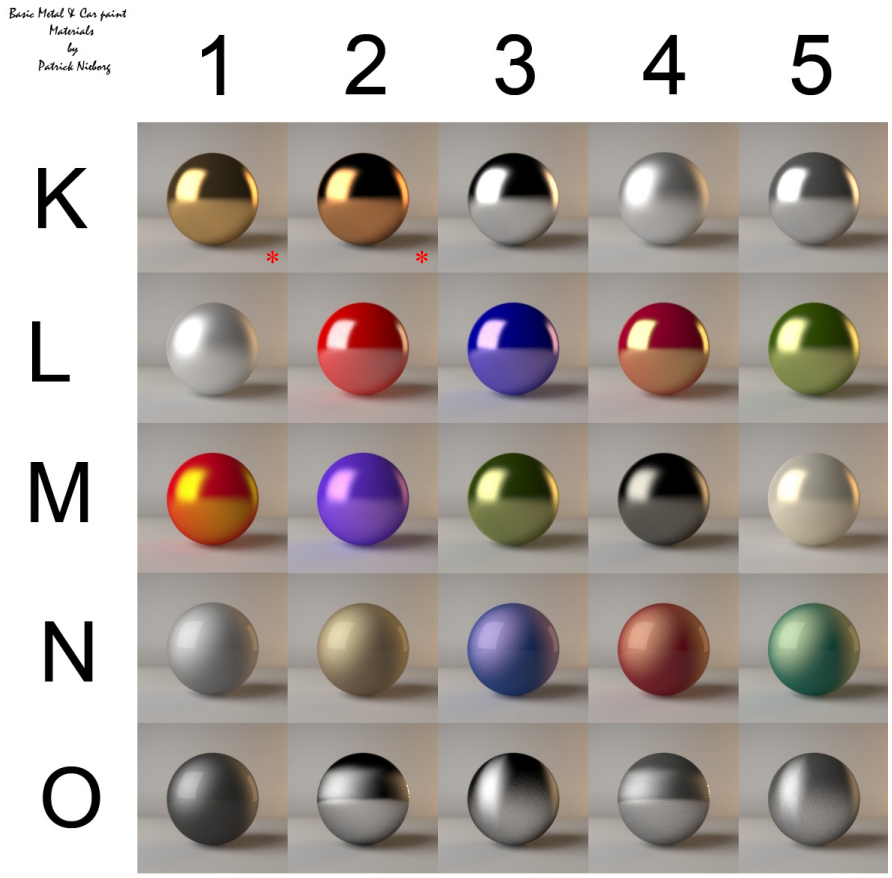


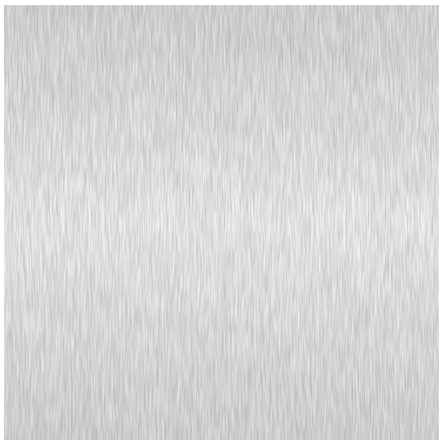
Material D3 + Bitmap Wood floor Material D3 + Bitmap + bump

I have included 2 more Material packs, where the second one is a Glass and other transparent Material collection. The Materials F1 to F5 are Frosted Glass and very expensive in rendering time (F1, F2 and F3 are quite good in rendering time). The last one J5 is a normal Glass with a procedural Windy Texture in the bump channel.

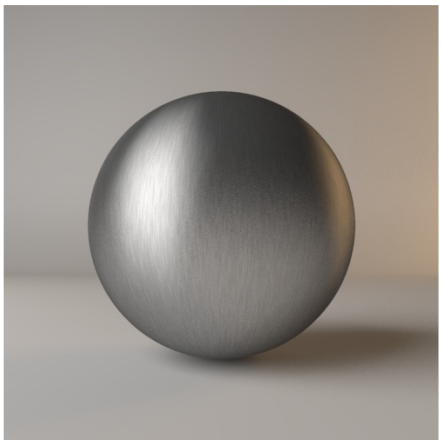


Here is the third Metal and Car paint collection. The last four O2 to O5 are Anisotropic (Ward) Materials. They have a particular behavior because you can adjust the amount of blurriness/sharpness of the specular reflection in the X and Y axis independently. These Materials are also known as Brushed Materials and are often used in Kitchens and cooking utilities, Elevators, Lamps, etc. The last two O4 and O5 have a bitmap applied on them to exaggerate the Brushed Metal effect (to give it a particular Brushed look though it is not necessary to do this; it is just another option to give your Material a personal touch ;))





Brushed Material Texture



Anisotropic (Ward) + Texture

The Materials shown here are Gamma corrected (Gamma 2.2). If you don't use Gamma correction , the colors used for the Materials may change. This is not a problem but with Metals like Gold or Copper, the color is very important and for that use the following color values. Gold (R = 238, G = 195, B = 132) Copper (R = 247, G = 171, B = 112)

Now, the only thing left is that you experiment with the different settings and try to make your own Material. By analyzing my Material collection, I hope you can find out how they were made and get some ideas for your own Materials. Two Studio scenes come along the Material Collection which I used to render my Materials and three Material preview scenes that Kerkythea can use to render the preview of your Materials in the Material Editor. To use the Material preview scenes, you have to copy the content of the folder called "preview scenes" in the folder called "Scenes" that is located in the subfolder "MaterialEditor" in the installation folder of Kerkythea. The Material collection has to be copied in the folder "Libraries" in the same subfolder. After you have copied the content in the correct folders you may try my preview render for the Material editor. To change the preview render in the Material Editor you open the Material Editor and select the Settings tab as shown in image 08 and then click the Material Editor Scene button. A window with different scenes will show up as image 09 shows; just select the one you like. Now, the preview of your Material Editor will change to the new scene.

I hope that this brief introduction to Kerkythea Material Editor can help you to get the kind of Materials you want and improve you images. Happy rendering! And see you at my next Tutorial.

Patrick Nieborg 15.06.2006

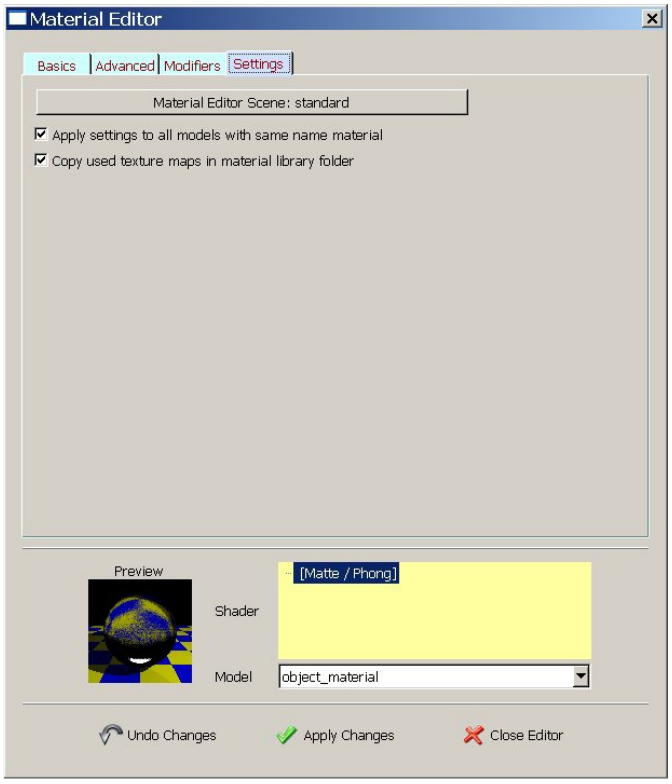


Image 08

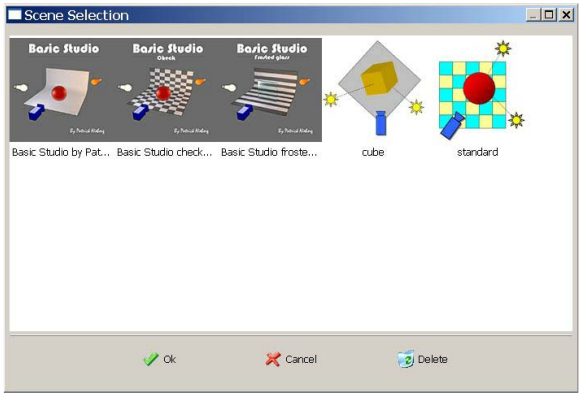


Image 09

Thanks to Giannis for providing Kerkythea and thanks to all the members of the Kerkythea Forum for their support.
You can join the Kerkythea Forum at
http://www.mfbb.net/kerkythea/?mforum=kerkythea

Copyright © 2006 Patrick Nieborg