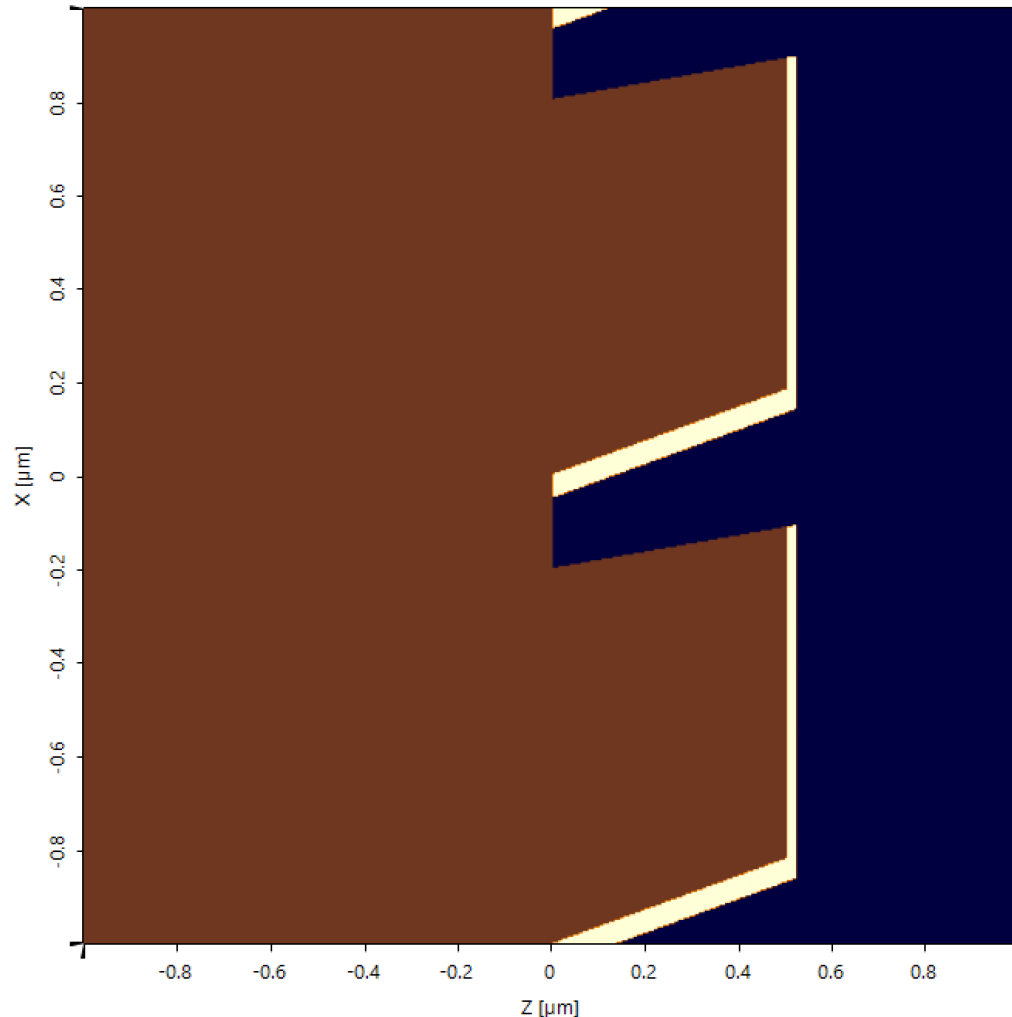


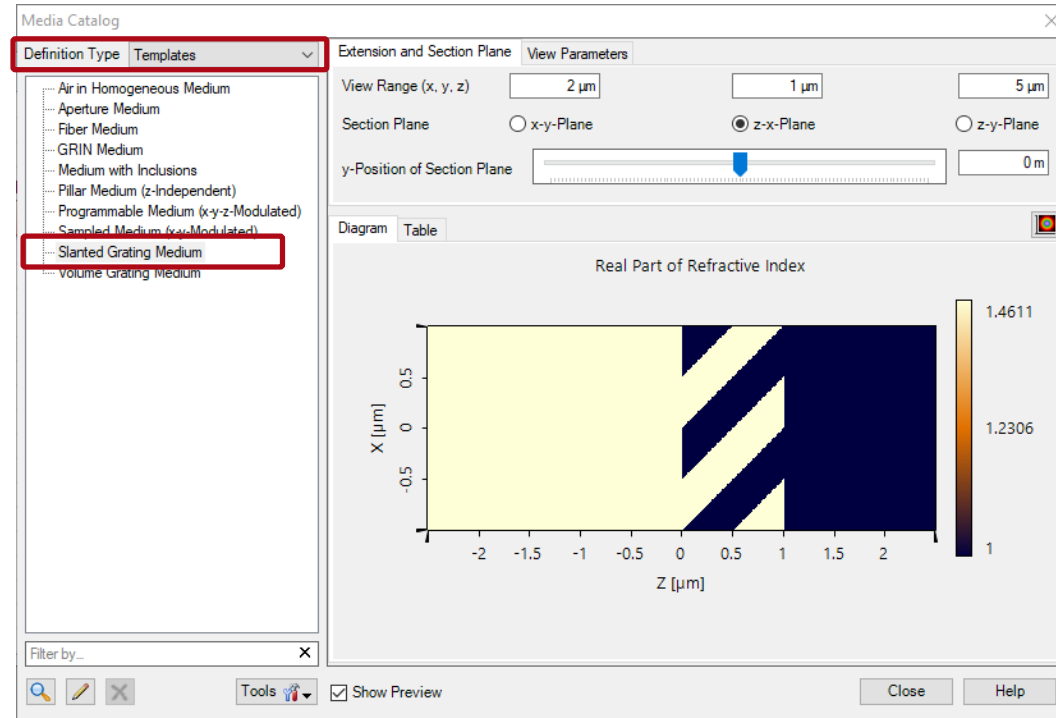
# Advanced Configuration of Slanted Gratings

# Abstract



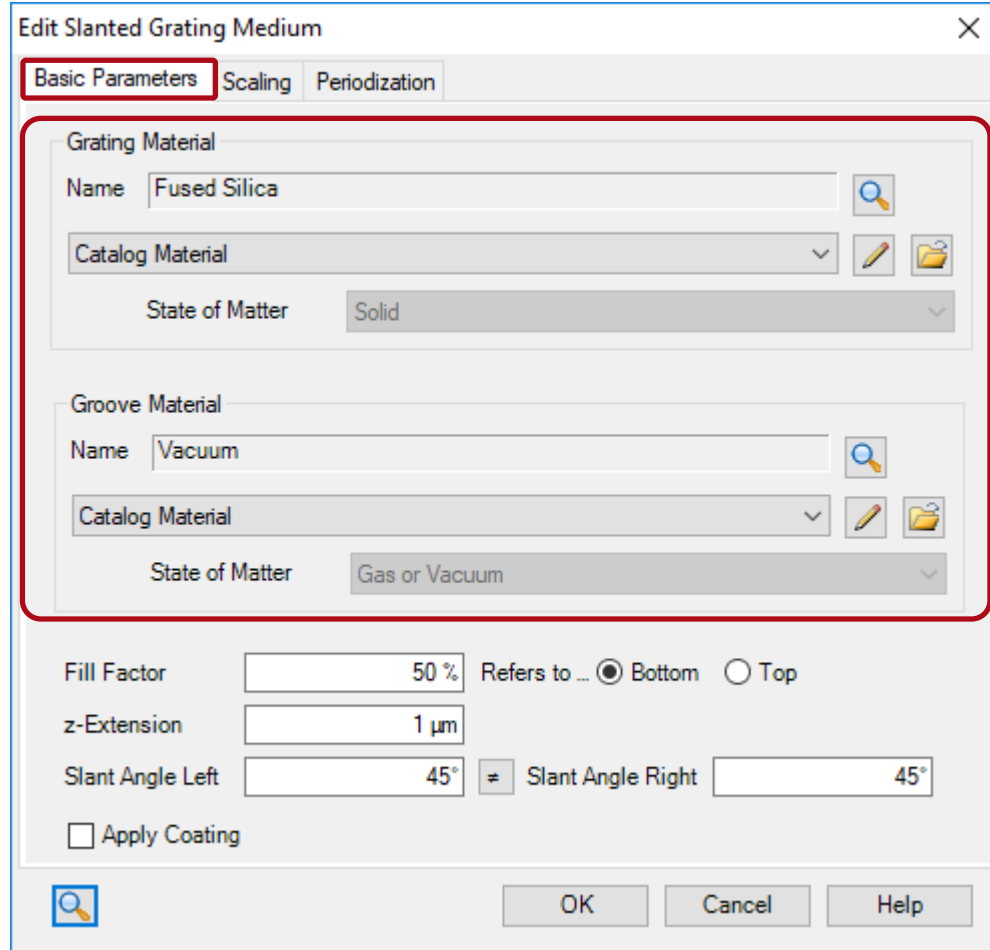
VirtualLab can be used to analyze arbitrary types of gratings. Due to the raising importance of gratings which exhibit slanted structures within complex optical setups also slanted gratings are available. The slanted grating is realized by a special optical medium, where the geometry can be defined, versatilely. Moreover, several advanced specification options are available, e.g. adding a full and partially coating layer. In this use case the available options for configuration are explained and their influence on the geometry of the grating are discussed.

# Slanted Grating Medium in Media Catalog



- The build-in slanted grating medium can be found in the embedded media catalog of VirtualLab.
- It can be used in order to set up complex optical grating structures (so-called stacks) and analyzed by applying the Fourier Modal method.

# Edit Dialog of the Slanted Grating Medium



- The slanted grating medium provides numerous options for customization of the periodic structure.
- First, the material of the grating ridges and of the grooves have to be defined inside the basic parameters tab.
- These materials can either be chosen from the material catalog, or defined by a constant index of refraction.

# Edit Dialog of the Slanted Grating Medium

Edit Slanted Grating Medium

Basic Parameters | Scaling | Periodization

Grating Material

Name: Fused Silica

Catalog Material: [dropdown]

State of Matter: Solid

Groove Material

Name: Vacuum

Catalog Material: [dropdown]

State of Matter: Gas or Vacuum

Fill Factor: 50% Refers to ...  Bottom  Top

z-Extension: 1 μm

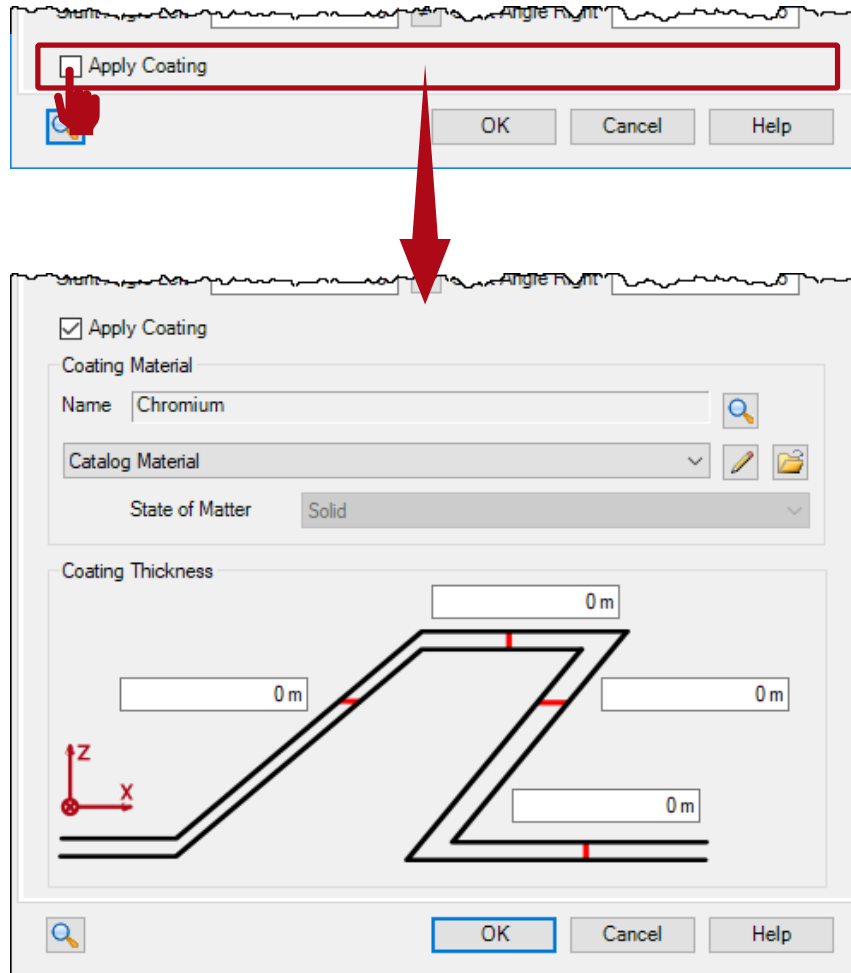
Slant Angle Left: 45° = Slant Angle Right: 45°

Apply Coating

OK Cancel Help

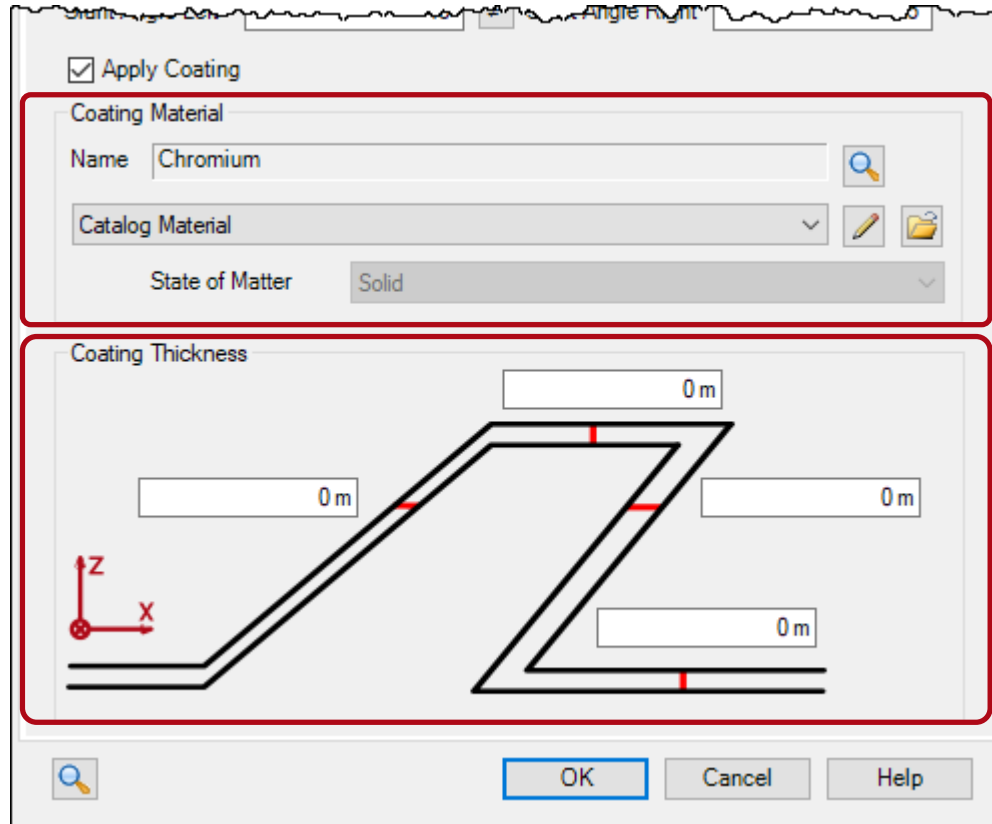
- Below the material settings, the geometrical parameters of the grating can be defined.
- The following parameters are available:
  - fill factor (defined either at top or bottom of the grating)
  - z-extension (grating height measured along z-direction)
  - slant angle left (slant angle of the left sidewall of the ridge)
  - slant angle right (slant angle of the right sidewall of the ridge)(in case of equal slant angles, the settings can be linked, by clicking the (un-)equal sign)

# Edit Dialog of the Slanted Grating Medium



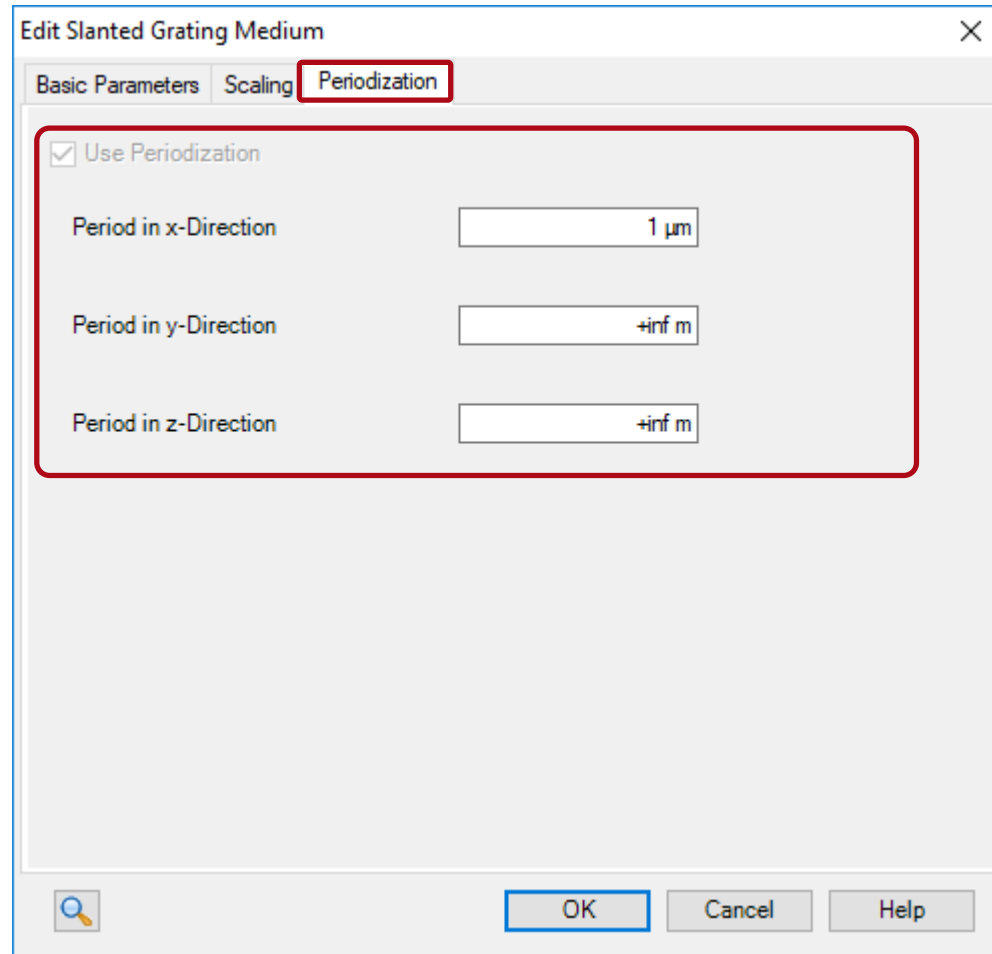
- In order to add a configurable coating, the Apply Coating option has to be activated.
- Now, additional options appear along with a sketch of the structure.

# Edit Dialog of the Slanted Grating Medium



- First, the material of the coating has to be selected.
- Again, the material can either be chosen from the material catalog, or defined by a constant index of refraction.
- Next, the thickness of the coating can be configured for each sidewall, top and bottom individually, as depicted in the sketch.

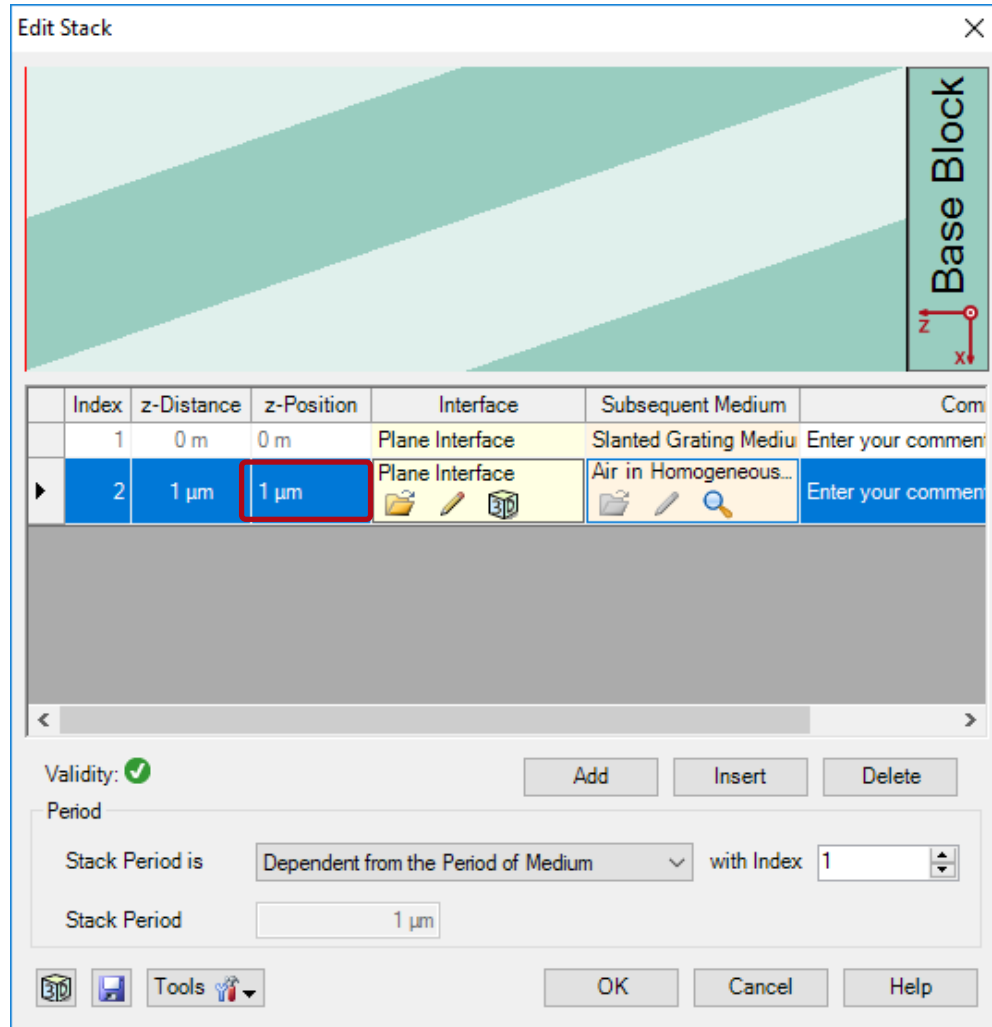
# Edit Dialog of the Slanted Grating



- Due to the slanted grating is defined by a medium, the period has to be set in the periodization tab.
- Because this special medium is designed for gratings, it is always configured to be periodic.



# Comment on Usage in Stacks

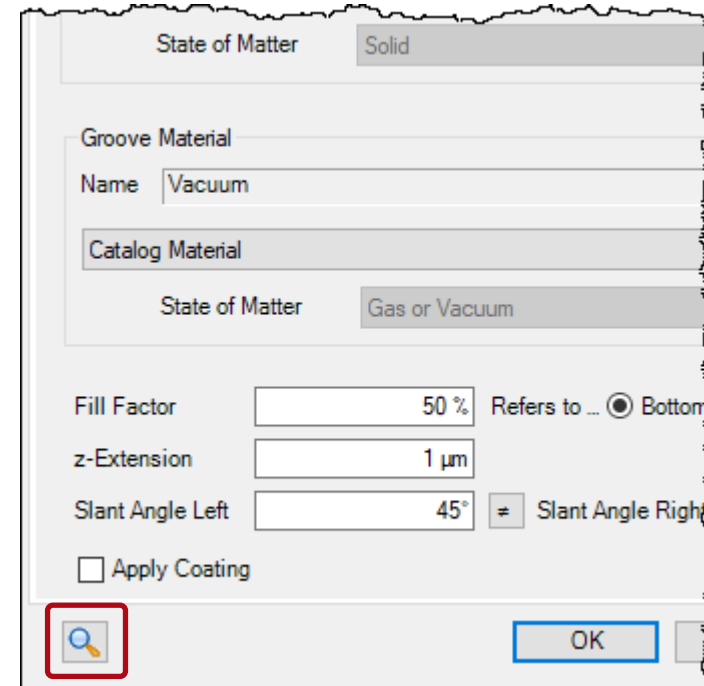


- For the usage of media within an optical stack it is necessary to define two surfaces which act as boundaries of the medium.
- In general, the distance between these interfaces has to be set manually.
- For the slanted grating medium the height (z-extension) of the medium is directly defined inside the medium configuration.
- Thus, the distance between the surfaces is automatically synchronized with the z-extension of the slanted grating medium.

# **Sample Configurations of Slanted Grating Medium**

# Samples of Slanted Grating Medium

- On the next slides some selected examples of the slanted grating media are shown.
- On the left side of each slide the edit dialog is depicted in order to exhibit the related parameters.
- On the right side, the preview of the medium is displayed.
- The preview of the media can be accessed by the preview button at the bottom part of the dialog.



# Sample Slanted Grating #1

Edit Slanted Grating Medium

Basic Parameters   Scaling   Periodization

Grating Material

Name: Fused Silica

Catalog Material: [dropdown]

State of Matter: Solid

Groove Material

Name: Vacuum

Catalog Material: [dropdown]

State of Matter: Gas or Vacuum

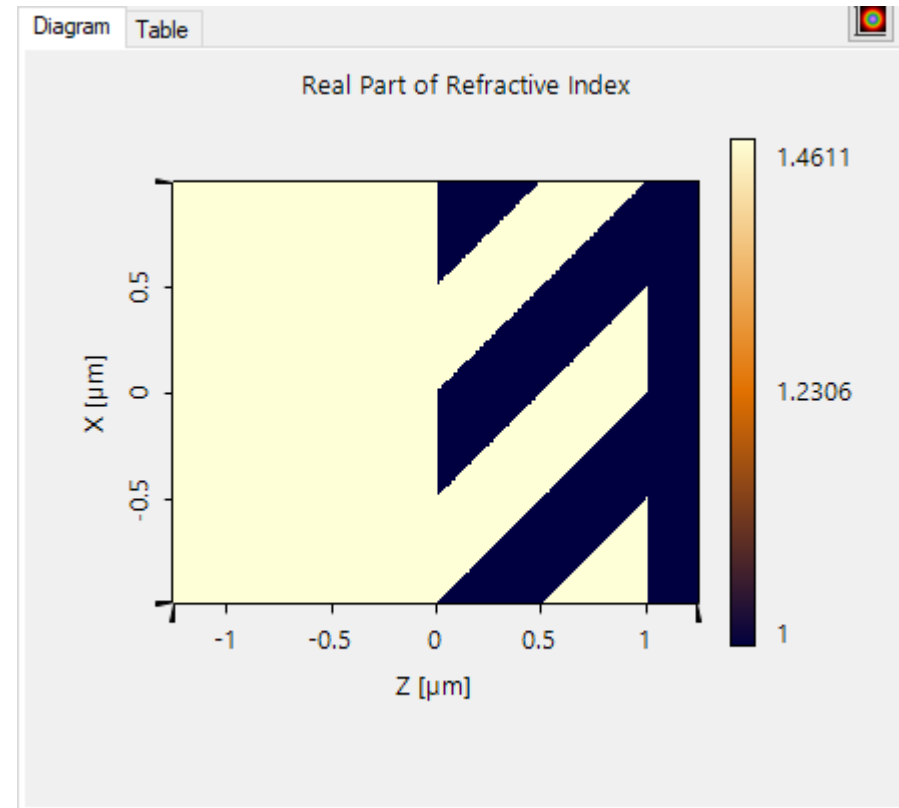
Fill Factor: 50%   Refers to ...  Bottom    Top

z-Extension: 1  $\mu\text{m}$

Slant Angle Left: 45°      Slant Angle Right: 45°

Apply Coating

OK   Cancel   Help



# Sample Slanted Grating #2

Edit Slanted Grating Medium

Basic Parameters   Scaling   Periodization

Grating Material

Name: Fused Silica

Catalog Material: [Dropdown]

State of Matter: Solid

Groove Material

Name: Vacuum

Catalog Material: [Dropdown]

State of Matter: Gas or Vacuum

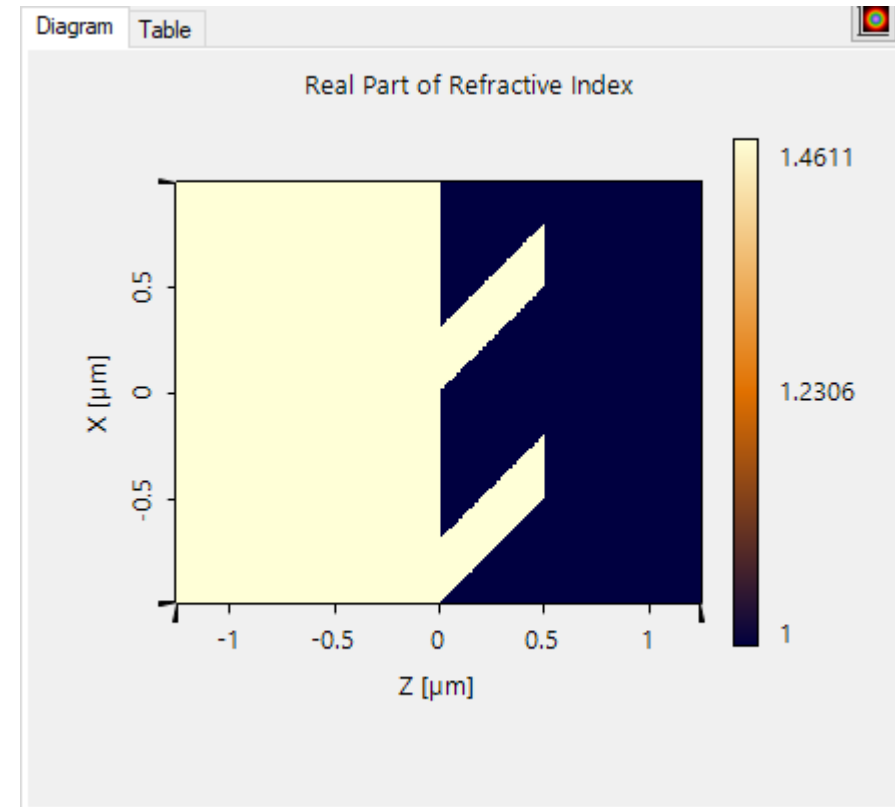
Fill Factor: 30%   Refers to ...  Bottom    Top

z-Extension: 500 nm

Slant Angle Left: 45°   ≠   Slant Angle Right: 45°

Apply Coating

OK   Cancel   Help



# Sample Slanted Grating #3

Edit Slanted Grating Medium

Basic Parameters   Scaling   Periodization

Grating Material

Name: Fused Silica

Catalog Material: [v]

State of Matter: Solid

Groove Material

Name: Vacuum

Catalog Material: [v]

State of Matter: Gas or Vacuum

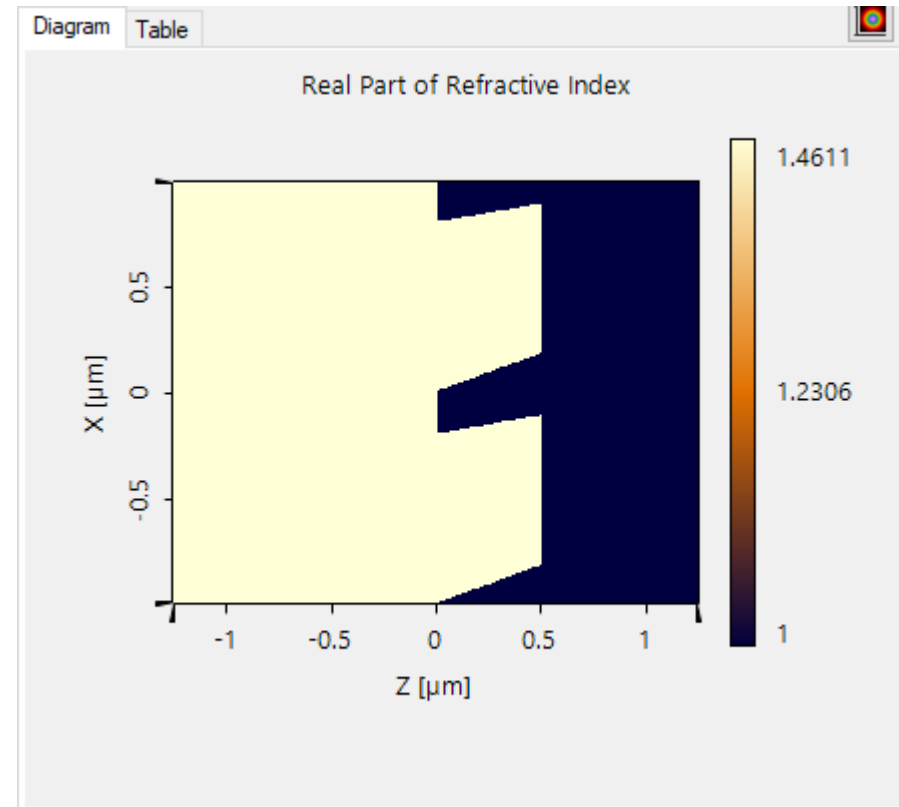
Fill Factor: 80%   Refers to ...  Bottom    Top

z-Extension: 500 nm

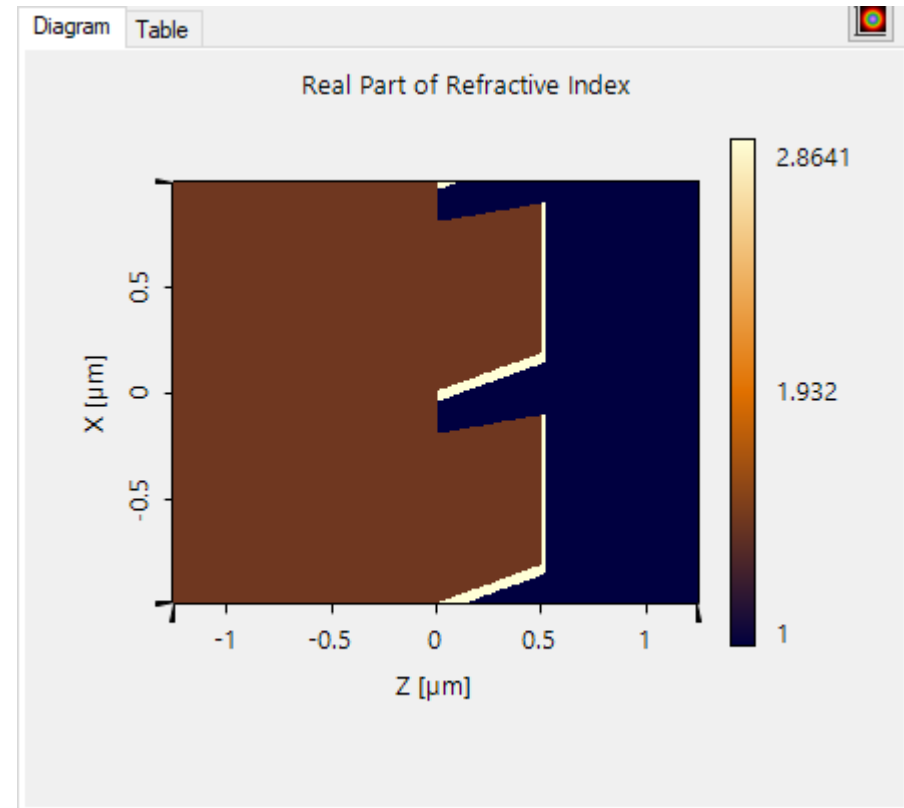
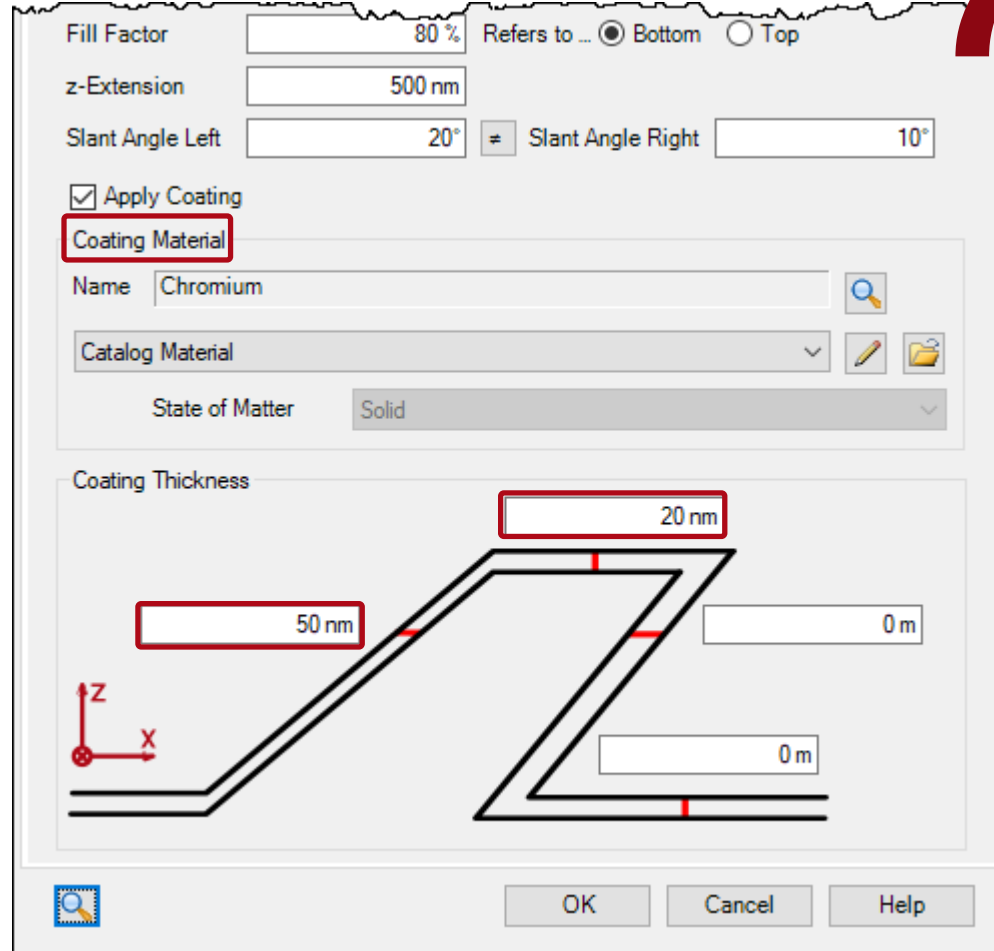
Slant Angle Left: 20°   ≠   Slant Angle Right: 10°

Apply Coating

OK   Cancel   Help



# Sample Slanted Grating #4



# Document Information

title	Advanced Configuration of Slanted Gratings
document code	MISC.0058
version	2.0
toolbox(es)	Grating Toolbox
VL version used for simulations	7.4.0.49
category	Feature Use Case
further reading	<ul style="list-style-type: none"><li>– <a href="#">Analysis of Slanted Gratings for Lightguide Coupling</a></li><li>– <a href="#">Parametric Optimization and Tolerance Analysis of Slanted Gratings</a></li><li>– <a href="#">Configuration of Grating Structures by Using Special Media</a></li></ul>