Optical Performance of Black Nickel Coated HDS

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The HDS suspension structure currently has two light control aspects: a baffle assembly surrounding the structure and a black nickel coating on the surface of the structure. The coating can cover sections of the HDS structure where the baffles cannot, but the coated structure requires more handling and must undergo specific cleaning and baking procedures. This document gives an overview on the optical performance of the black Ni coated HDS structure.

Unfortunately, the aluminum material has a hairline finish that reflects the laser beam as either a vertical or horizontal line depending on the material's orientation. It is difficult to analyze scatter data for materials that distort the beam profile compared to a polished material. Since there is no data on the uncoated HDS structure, the HDS scatter data was compared to a sample of mill finish aluminum.

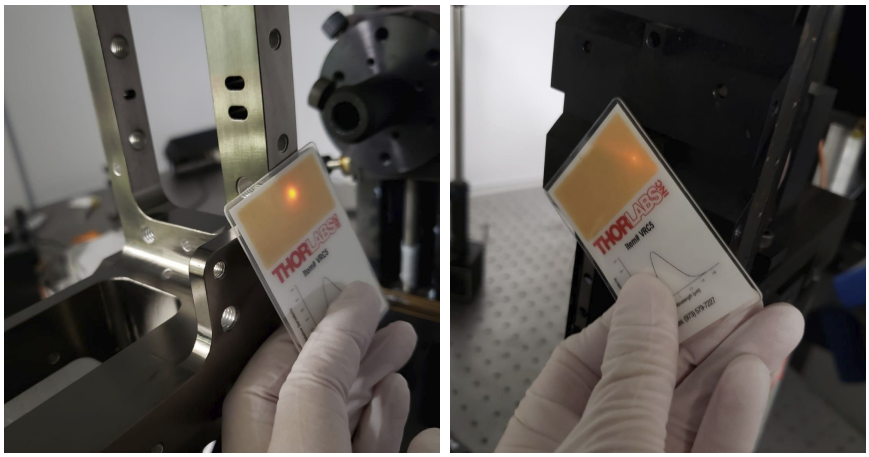


Figure 1. Laser beam profile before (left) and after (right) hitting the black Ni coated HDS structure. The beam profile changes from a clearly defined point to a horizontal line.

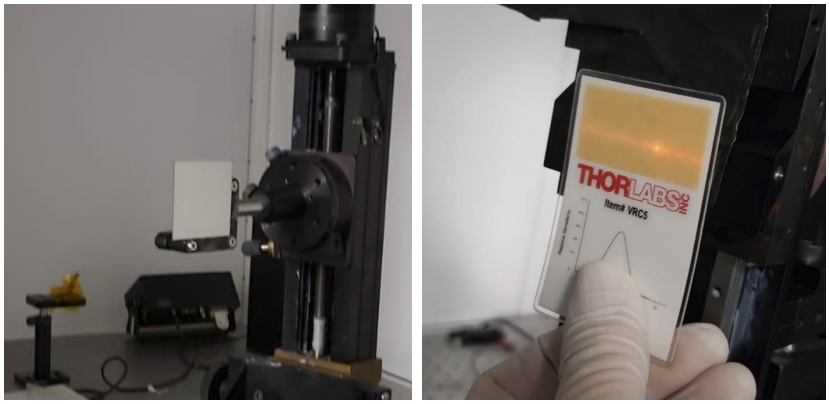
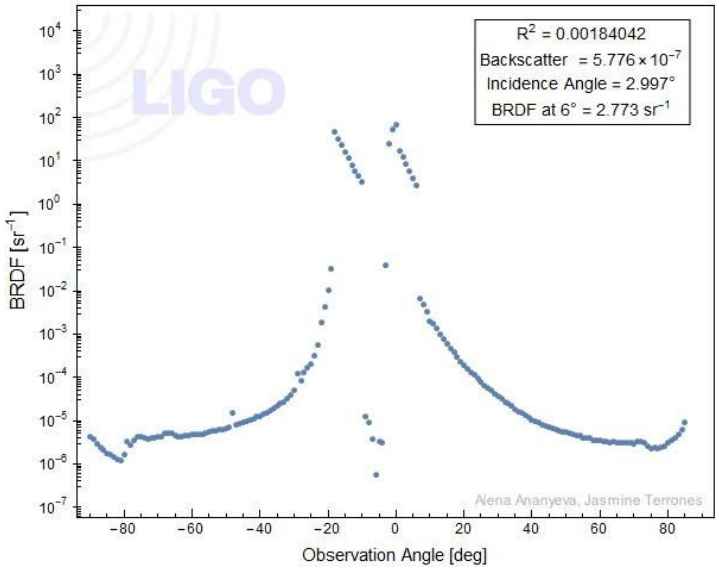


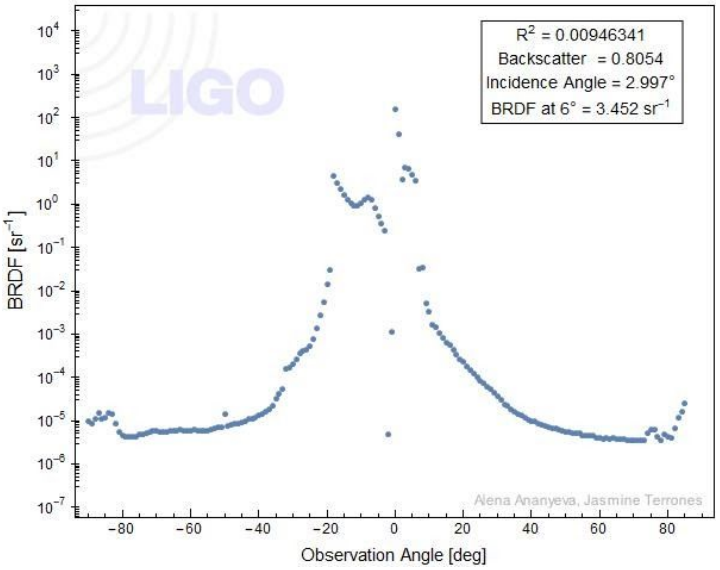
Figure 2. Aluminum sample in scatterometer (left) and laser beam profile after hitting the sample (right). The uncoated sample and HDS structure distort the laser beam in a similar way.

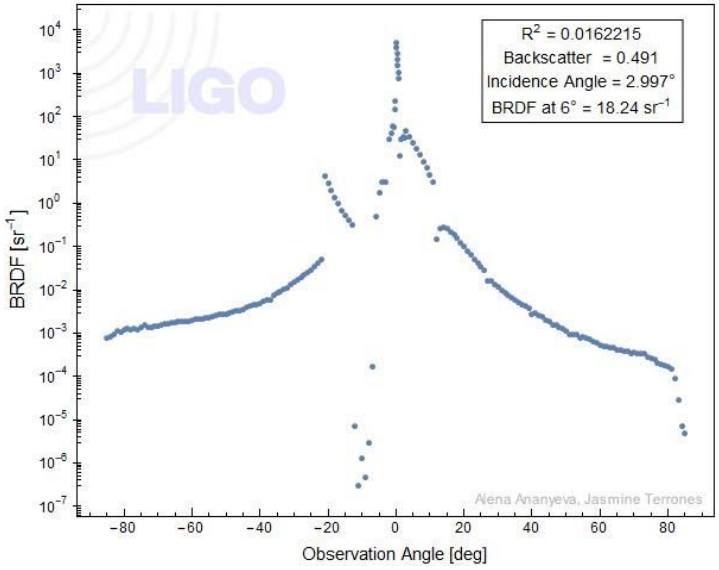
Figure 3. HDS structure on Scatterometer. The first set of measurements were taken with this configuration. For future measurements, the laser was pointed at another surface on the structure.

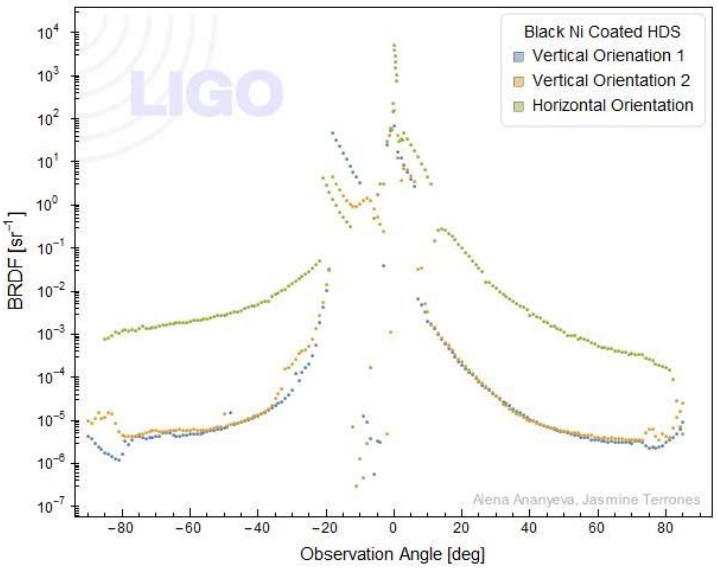
The shape of the structure makes it difficult to take accurate measurements. Scatter data was taken at three different points on the structure and plotted below.

Black Ni Coated HDS Plots:



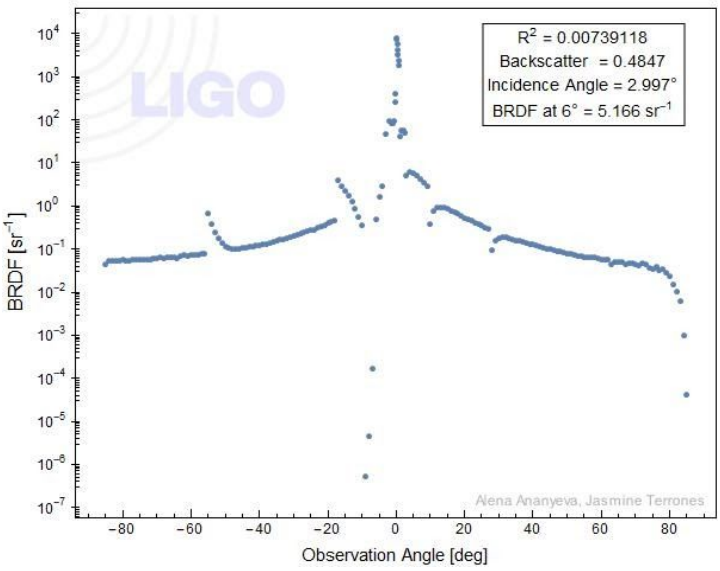


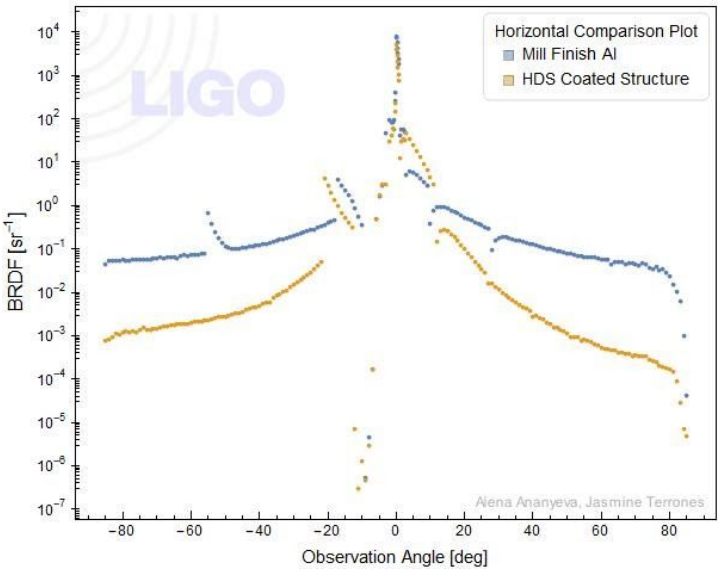




The vertical orientation plots both have very strange dips near the top of their curve. This is likely due to some calibration error on the scatterometer. The HDS structure will be measured again in the vertical orientation to obtain better data

Black Ni Coated HDS and Mill Finish Aluminum Comparison Plots:





Based on the plots, it is clear the coated HDS had significantly less backscatter relative to the aluminum sample. For all three measurements, the HDS coated structure had at least 100 times less backscatter than the uncoated aluminum. The integrated scatter for the two samples was evaluated between the angles of 20-80°. The integrated scatter for the Aluminum sample was much larger than the HDS coated structure, with 54.9% and 781% respectively. These values are extremely high (TIS should never be more than 100%), due to errors made by the scatterometer. However, these measurements are valuable in comparing the diffuse reflection of the two materials.