Silanization of Sapphire Surfaces for Optical Applications

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Binding properties and orientation of 3-mercaptopropyltrimethoxy silane (MPTMS) layers at crystalline sapphire (0001) surfaces were determined by water contact angle measurements, infrared reflection absorption spectroscopy, atomic force microscopy, and X-ray photoelectron spectroscopy. Infrared reflection absorption spectroscopy measurements suggest an almost perpendicular arrangement of the MPTMS molecules to the substrate surface. Sapphire substrates comprising microfabricated structures of silicon dioxide and gold were investigated by peak force tapping atomic force microscopy before and after a dodecanthiol modification. These adhesion force studies between a silicon nitride AFM tip and this substrate were used to define the silane binding properties on these surfaces. As expected, the Al-O-Si bond was determined to be responsible for the layer formation at the sapphire substrate surface.

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