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Hydrophobic thiol-ene surfaces fabricated via plasma activation and photo polymerization

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Alumina, such as glazed alumina for electrical insulator, operated in an open field subjects to a very harsh condition; resulting in lifetime shortening. Coating hydrophobic layer on alumina surface can help prolonging its lifetime. In this study, 25x25 mm alumina sheets were used as substrates. The hydrophobic composite polymers were prepared by (3-mercaptopropyl) trimethoxysilane (MPTMS), 2,4,6,8-tetramethyl-2,4,6,8 tetravinylcyclotetrasiloxane (TMTVSi), pentaerythritoltetra(3-mercaptopropionate)(PETMP), 2,2-dimethoxy-2-phenylaceto phenone(photoinitiator) and heptadecafluorodecylmethacrylate(HEFDMA) via the thiol-ene reaction. The alumina sheets were first activated by dielectric-barrier discharge plasma to improve its adhesion.All the polymers were found to optimize at the ratio of (MPTMS:TMTVSi:PETMP:HDFDMA) to 4:2:1:2 for coating on the alumina substrate. To enhance polymerization, 2,2-dimethoxy-2-phenylaceto phenome was also used as a photoinitiator A proper mixing sequence in the thiol-ene reaction results in film with excellent surface retention after prolong soaking in solvent such as acetone. FTIR shows that S-H and C=C functional groups have significantly changed after photopolymerization and thermally cured. The static contact angle increase from mere $53.0^{\circ}\pm1.5^{\circ}$ of the uncoated substrate to $120.0^{\circ}\pm1.2^{\circ}$ after coating. SEM shows the film with clear appearance of a few-micron thick. Under AFM, the coated surface roughness was about 9.3 nm with evenly distributed spikes of a few nanometer in height. The cross-cut test also confirmed the film was very smooth and none of the square of the films detached.

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