Erosion Characteristics and Optical Properties of State-of-the-Art, Erosion-Resistant Coatings on Infrared Windows: Boron Phosphide, Gallium Phosphide, and Zinc Sulfide on Multispectral Zinc Sulfide

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Abstract: Optical properties and rain and sand erosion resistance of the following infrared window materials were measured: (1) Barr & Stroud boron phosphide coating on multispectral **zinc** sulfide, (2) Barr & Stroud gallium phosphide coating (with a thin outer layer of boron phosphide) on multispectral **zinc** sulfide, (3) Raytheon **zinc** sulfide coating on multispectral **zinc** sulfide, (4) Texas Instruments bulk gallium phosphide, (5) polycrystalline magnesium fluoride, and (6) single-crystal silicon. ZnS-coated ZnS has low optical emission for operation at 500 deg C in both the 3-5 and 8-10 micrometers regions. Bulk GaP and bare MgF2 have low emission only in the 3-5 micrometers region. BP/ZnS and BP/OaP/ZnS have prohibitive optical emission at 500 deg C in both the 3-5 and 8-10 micrometers regions. In whirling arm rain erosion experiments, none of the coated materials was as durable as bare MgF2. BP/ZnS is more durable than ZnS/ZnS, but subsurface damage preceded damage to the BP coating in BP/ZnS. GaP fractured easily on orthogonal crystal planes upon raindrop impact. In sand erosion experiments, BP and BP/GaP/ZnS were best and MgF2 was second most durable.

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