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 Materials Sciences ■ Coatings, Colorants and Finishes

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.

Limitations:  APPROVED FOR PUBLIC RELEASE DOCUMENT PARTIALLY ILLEGIBLE

Description: Summary rept. Oct 94-Aug 95

Pages: 67

Report Date: MAY 96

Report Number: A412903


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