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Erosion of a grooved surface caused by impact of particle-laden flow SOHYUN JUNG, EUNJIN YANG, HO-YOUNG KIM, Seoul Natl Univ — Solid erosion can be a life-limiting process for mechanical elements in erosive environments, thus it is of practical importance in many industries such as construction, mining, and coal conversion. Erosion caused by particle-laden flow occurs through diverse mechanisms, such as cutting, plastic deformation, brittle fracture, fatigue and melting, depending on particle velocity, total particle mass and impingement angle. Among a variety of attempts to lessen erosion, here we investigate the effectiveness of millimeter-sized grooves on the surface. By experimentally measuring the erosion rates of smooth and triangular-grooved surfaces under various impingement angles, we find that erosion can be significantly reduced within a finite range of impingement angles. We show that such erosion resistance is attributed to the swirls of air within grooves and the differences in erosive strength of normal and slanted impact. In particular, erosion is mitigated when we increase the effective area under normal impact causing plastic deformation and fracture while decreasing the area under slanted impact that cuts the surface to a large degree. Our quantitative model for the erosion rate of grooved surfaces considering the foregoing effects agrees with the measurement results.

Ho-Young Kim
Seoul Natl Univ

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