Is the hazard of abrasive wear positively correlated with particle size?

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Abrasive wear can have a detrimental tribological effect on machinery, especially in the mining and construction industries. To prolong machinery lifetime and cut down energy consumption, a thorough understanding of abrasive wear is essential. In our work, bearing steel (100Cr6) pins and discs, in a flat-on-flat contact, were tribologically tested with various Al2O3-based slurries as interfacial media, to shed light on the governing abrasion mechanisms in a lubricated contact. Using slurries with different particle sizes, ranging from 3 to 29 µm, we studied the influence of particle size on wear quantity and trends. Surprisingly, particle size had a non-monotonic effect on wear. Additionally, the slurries with small particle sizes (3 or 5 µm) yielded much more unstable frictional evolution and inhomogeneous wear than slurries with large particle sizes (13 or 29 µm. The 5 and 13 µm slurries were then selected for further investigations, and it was found that the unstable frictional evolution and inhomogeneous wear are strongly correlated with the disc's initial waviness (albeit minimized and controlled for). Further insights related to time- and velocity-dependent frictional stability will also be shown.

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