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Experimental Determination of Powder Film Shear and Damping Characteristics

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ABSTRACT

Thin powder films are proposed as a damping medium to overcome the temperature and creep limitations associated with viscoelastic dampers. Its basis is the established quasi-continuum model for fine powders successfully applied to such devices as bearings, piston rings, conventional dampers and others. In developing this technology over the past ten years it has been shown that satisfactory performance with respect to levels of load capacity, friction, etc. can be achieved with powder films which operate in a quasi-viscous mode much as fluid films do. Direct measurements have demonstrated that high levels of damping are possible at high frequencies even with extremely small excitational amplitudes, and that the achieved stiffness and damping are insensitive to temperature. Apart from its physical characteristics, measured stiffness and damping of powder films were shown to be related to powder compaction pressure, relative velocity, film thickness and imposed shear stress. With its rheological characteristics established thin powder layers should then be applicable as dampers in such devices as turbine airfoils, struts, guide vanes, exhaust ducts and similar systems subject to high frequency vibrations and high temperatures.

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