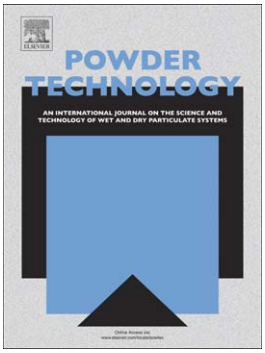


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# Investigation of the energy dissipation of different rheology behaviors in a non-obstructive particle damper

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**Abstract** Non-obstructive Particle Damping (NOPD) is widely used as an effective passive damping technique. However, the understanding of the energy dissipation mechanism and meso-scale behavior of the granular system in NOPD is not sufficiently in-depth. In this paper, the damping effectiveness of NOPD, as represented by the contour plot of the loss factor, was analyzed in combination with the motion modes of the granular system, and the energy dissipation mechanism was illustrated at the meso-scale. The results show that the different motion modes of rheology behaviors and meso-structure contribute to the variations in the damping effectiveness. Generally, the NOPD has the optimal damping effectiveness in the buoyancy convection state. The purpose of this paper is to provide a better understanding and theory support for the design and application of NOPD.

***Keywords*** *NOPD; rheology behavior; meso-structure; energy dissipation*

## 1. Introduction

Non-obstructive Particle Damping (NOPD) is widely used as an effective passive damping technique in aerospace [1-4], mechanical engineering [5-7] and construction [8-10] because of its simplicity and high efficiency. It consists of small diameter holes or cavities that are filled with metallic or non-metallic particles at a high vibration amplitude location of a primary structure. The mechanism of NOPD for reducing the vibrations is based on the dissipative nature of the combined effects of inelastic collisions and frictional losses when the particles in the cavity collide and rub against themselves and the cavity walls [11-13].