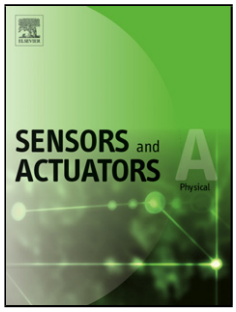

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A Novel Sprayable Fast-Responding Pressure-Sensitive Paint Based on Mesoporous Silicone Dioxide Particles

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Highlights

- This novel sprayable fast-responding pressure-sensitive paint (Fast PSP) uses mesoporous silicone dioxide particles as hosts for luminescent molecules
- The main merit of mesoporous particles is to create highly porous structure and polymer-free environment for luminescent molecules
- This mesoporous-particle-PSP (MP-PSP) features both fast response (close to regular PC-PSP) and high durability (significant improvement over PC-PSP)
- Improvements in pressure sensitivity and photostability have also been achieved
- MP-PSP have shown great potential in high-speed and unsteady aerodynamic testing

Abstract

A novel formulation of sprayable fast-responding pressure-sensitive paint (PSP) has been developed which uses mesoporous, hollow silicone dioxide particles as hosts for luminescent molecules (PtTFPP). The mesoporous particles are formed by nano-scale particles through Van del Waals force and chemical bonds, providing favorable environment for luminophore deposition. The resulting highly porous structures facilitate oxygen diffusion within the PSP binder which leads to a response time as low as 50 μs. More importantly, the current formulation can resolve the conflict between dynamic response and paint durability (in high-speed flows). The mesoporous-particle-based PSP (MP-PSP) prepared by mix-and-spray method features both fast response (about 100 μs) and high paint durability due to its highly porous structure and uniform luminophore distribution throughout the binder. Meanwhile, other negative effects of bonding polymer on PSP's sensing properties are reduced, which results in increased pressure sensitivity and greatly improved photostability. The influence of particle size, paint thickness and fabrication method on sensing performance is also discussed in detail. This novel MP-PSP has shown great potential for applications in high-speed, unsteady aerodynamic testing.

Keywords: Pressure-Sensitive Paint; Mesoporous Silicone Dioxide; Fast Response; Photostability; Durability