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Abstract Formulary

Presentation type: **Oral** ✔ **Poster** ☐

Title: Multifunctional Thin-Film Composite Polyimide Aerogels with Enhanced Mechanical Flexibility and Controllable Dielectric Properties

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ABSTRACT (Space limited to 2200 characters)

Aerogels are a novel class of porous materials, which due to their highly porous nanostructured network, exhibit ultrahigh thermal insulation properties and ultralow dielectric constant. In the past decade, organic aerogels particularly polyimide (PI) aerogels have drawn significant attention due to their high thermal stability and excellent mechanical performance. Previous research on PI aerogels demonstrated the successful tailoring of properties through altering the backbone compositions, crosslinkers, and varying synthesis parameters. Nevertheless, the development of conformal PI aerogels in thin-film configuration has been a longstanding challenge. As aerogels network structure mainly forms during the initial gelation and has very sensitive relations with intermolecular forces in that stage, controlling and tailoring the thin-film aerogels structure and their uniformity are complicated. In this study, novel conformal composite PI aerogels in thin-film configuration are reported. Thin-film aerogels with controllable thickness and uniformity are fabricated with excellent mechanical flexibility and high service temperature. Through the incorporation of graphene-based nanoparticles, it is demonstrated that dielectric properties can be tailored which is of great interest in electronic microsystems for reducing the signal delay time. Considering the rapid development of the microelectronics industry, the developed multifunctional thin-film aerogels in this study can have a widespread application in flexible printed circuit boards, intermetal dielectric layers, and flexible electronic devices.