

Development of Internal Structure Analysis Technology for Controlling Millimeter-Wave Transmissivity in Coating Films

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KEY WORDS: Materials, Paint, Test/Evaluation, Millimeter-Wave Transmissivity, Coating, Structure Analysis [D3]

We are advancing the development of high-performance bumper material technology that can achieve both electromagnetic wave transmissivity and designability at a high level. As part of this effort, we have established an automated analysis technology for the micro-scale three-dimensional filler structure within the coating film. This technology aims to elucidate the factors influencing electromagnetic wave transmissivity in bumper coatings and to efficiently determine the material and process conditions that meet the target performance. As a result, the following findings were obtained.

- (1) We developed a technology capable of automatically classifying conductive/non-conductive fillers with high precision from 3D images of coating film (Fig.1). This enables the extraction of specific fillers from images of coating films containing multiple types of fillers, leading to the derivation of feature parameters and the elucidation of control factors.
- (2) We established a technology capable of automatically analyzing contributing factors to millimeter-wave transmissivity (thickness- and surface-direction spacing, number of overlapping fillers in the thickness direction, Fig.2).
- (3) We conceived a material technology capable of controlling microscale filler structures to achieve both millimeter-wave transmissivity and designability. The developed product has improved millimeter-wave transmissivity compared to the current product while maintaining equivalent optical properties (Fig.3). Structural analysis also yielded structural feature parameters linked to evaluation results (increased thickness direction spacing, equivalent surface direction spacing, and reduced number of overlapping layers, Fig.4).

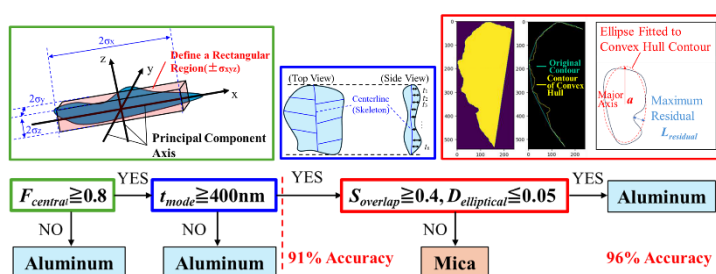


Fig. 1 Classification Flow of Aluminum and Mica

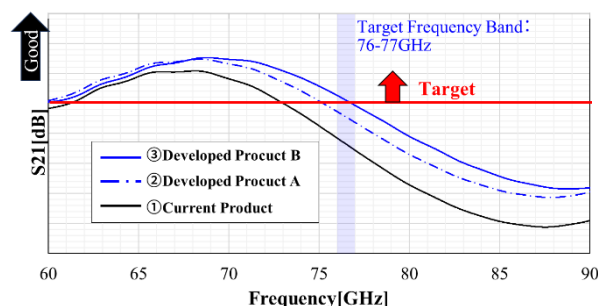


Fig. 3 Millimeter Wave Transmissivity of Prototypes

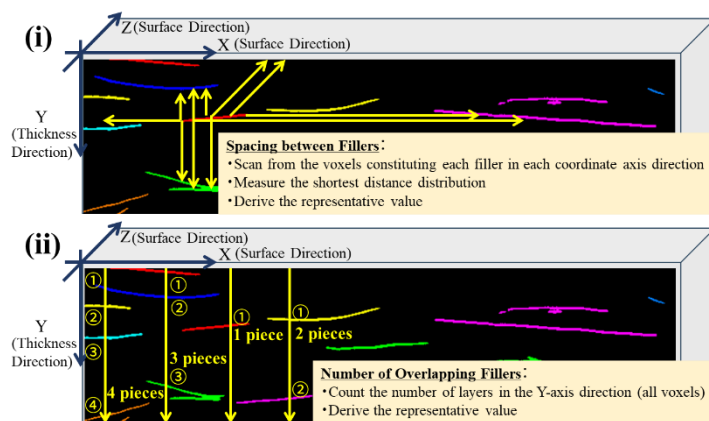


Fig. 2 Concept for Deriving Structural Features

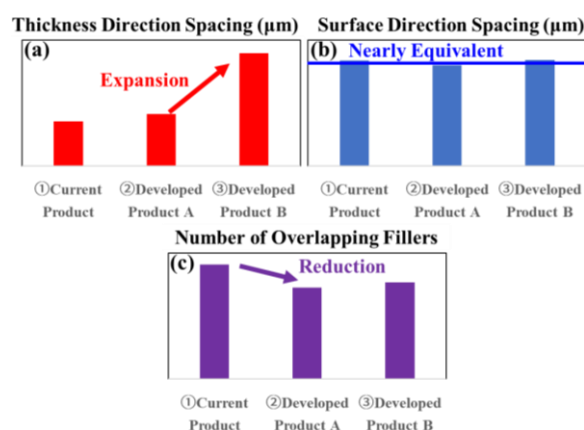


Fig. 4 Structural Feature Analysis Results of Prototypes