ヘテロ凝集と熱溶融によりニッケルめっき導電性粒子表面に形成した絶縁層の機械的安定性の評価

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Evaluation of the Mechanical Stability of Insulating Layer Formed on the Surface of Nickel-Plated Conductive Particles Prepared by Heterocoagulation and Thermal Fusion ([1]*Graduate School of Engineering, Chiba University*) ○Tomonao Naruhashi,[1] Tatsuo Taniguchi,[1] Takashi Karatsu[1]

Since the flat panel displays have become increasingly high-definition, the conductive particles applied to the anisotropic conductive films need to be covered with an insulating layer to prevent electrical shorts. In this study, we synthesized the polymer shell particles carrying cationic phosphonium groups by emulsifier-free emulsion polymerization. An insulating layer was constructed on the surface of nickel-plated conductive particles by heterocoagulation between the nickel-plated core particles and the polymer shell particles and successive thermal fusion. The size of polymer particles could be controlled by the feed concentration of 4-(vinylbenzyl)triethyl phosphonium chloride. The nickel-plated conductive core particles were uniformly covered with the polymer shell particles by mixing particles in aqueous solution of NaCl (5 mM) at 30 °C for 6 h. The compressive displacement up to the detection of the connection resistance by a micro-compression tester increased with an increase in the shell particle size, indicating that the mechanical stability of the insulating layer was improved.

Keywords : Emulsifier-free Emulsion Polymerization; Heterocoagulation; Nickel-plated Conductive Particles; Polymeric Particles; Insulating Layer

フラットパネルディスプレイの高精細化に伴い、異方性導電フィルムに添加される導電性粒子は、粒子同士の接触による電気的ショートを防ぐため絶縁層で被覆することが求められる。本研究では、ソープフリー乳化重合によりホスホニウム基を有する高分子微粒子を合成し、ヘテロ凝集と熱溶融法によりニッケルめっき導電性粒子の表面に絶縁層を形成した。合成した高分子微粒子のサイズはホスホニウムモノマーの添加量により制御できた。ヘテロ凝集の条件（[NaCl] = 5 mM, Temp. = 30 °C, [shell particles] = 3.0 eq., Time = 6 h）を最適化し、均一かつ被覆率の高い絶縁層を有した被覆粒子を調製できた (Figure 1) 。微小圧縮試験機により粒子圧縮時の接続抵抗を測定して、絶縁層の機械的安定性を評価した。高分子微粒子のサイズが大きくなるほど絶縁層の機械的安定性が向上することを明らかにした。

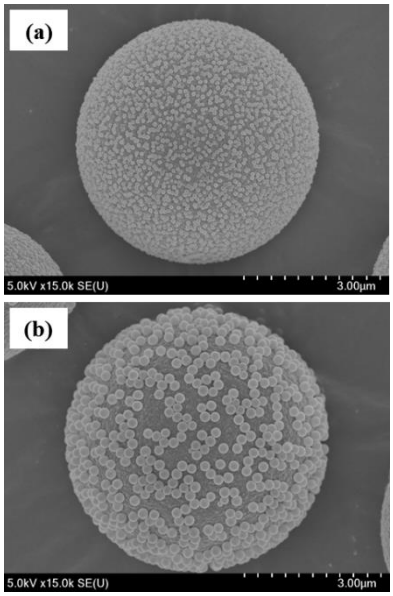

Figure 1. The conductive nickel-plated core particles covered with polymer shell particles. The shell particle size (a): 78 nm, (b): 217 nm.