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Aqueous suspensions of glass silicate dielectric powders for ink-jet printing applications

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Abstract

Ink-jet printing (IJP) is a rapid prototyping method which is very promising for the manufacturing of multilayer hybrid circuits. Before the formulation of inks, the first step consists to ensure the stability of dielectric powder suspensions with the specifications required for the IJP process in terms of solid content, particle size, rheology, and stability versus sedimentation. A commercial glass silicate powder currently used as a dielectric material was studied during an attrition milling (i) for low ceramic loading (3 vol.%) (ii) for significant ceramic loading (20 vol.%) with different dispersants: polyelectrolytes with carboxylate groups, and sulfate groups. The milling step impact on the surface chemistry of the powder was investigated in both cases. A potassium polycarboxylate was found to be the most efficient dispersant, and the optimization of the dispersant rate was carried out through zeta potential measurements, viscosity, dispersant adsorbed rate, and sedimentation tests. An attempt of correlation between some of these properties is proposed. The preliminary ejection tests obtained with an ink prepared from an optimized suspension allowed to generate a wide range of drop velocity (0.7 to 4.2 m/s) and drop diameter (47 to 56 μm), which will be useful in a further step to optimize the characteristics of green ink-jet printed dielectric layers.

Keywords: ink-jet printing; multilayer hybrid circuit; dispersion; attrition milling

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