Measurements of binary powder mixture resistivities

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***Abstract*—Effective electrical resistivities of binary powder mixtures were influenced by the resistivities of the component materials in pure form, by particle sizes, and by sticking between the different particle. Resistivities of binary powder mixtures were measured and compared to the Random Model (RM). Effective resistivities predicted using the RM assume that particles in mixtures are randomly packed and that the effective resistivities of mixtures can be calculated from the component resistivities and their proportions. RM predictions were accurate when potato starch and corn starch were mixed with icing sugar. As a result, resistivities followed a straight line on a semi-log plot as a function of the concentration. However, when NaCl particles were mixed with icing sugar, the effective mixture resistivities increased linearly with increasing proportions of icing sugar. Thus, the measured resistivities of these mixtures were significantly larger than predicted by the RM. Unlike potato starch and corn starch particles, NaCl particles were larger than icing sugar particles. Using an optical microscope, we observed that the finer, more numerous sugar particles coated the larger NaCl particles. We speculate that the different particles became oppositely charged by triboelectrification when the mixtures were prepared causing the particles to stick. As a result, the mixtures were not randomly packed and mixtures were more insulating than predicted by the RM. When mixtures were prepared using NaCl particles having nearly the same sizes as the sugar particles, results predicted by the RM were obtained.**