

## Measurement of Electric Currents in Electrostatic Spray Painting System

Hua-Tzu Fan<sup>\*</sup>, Hong-Hsiang Kuo, and Yar-Ming Wang  
Global Research & Development Center  
General Motors Corporation  
Warren, MI 48090-9055 USA

### Abstract

Many parameters affect the electrostatic painting process. And numerical modeling provides an economical method to optimize the operating parameters in order to achieve maximum transfer efficiency and good paint finish quality. Due to the complexity of the electrostatic painting process, no complete theoretical model is available to predict the required parameters such as droplet size and charge-to-mass ratio distributions. Experimental data are needed in order to get more accurate modeling results. By measuring the electrical currents involved in the electrostatic painting process under different operating parameters, the droplet charge-to-mass ratios can be calculated. Using design of experiments (DOE) techniques, for each type of paint, the number of experiment can be reduced to 26 for 5 operating parameters of 3 levels while still generate enough data for this study. The experimental results showed that for both waterborne and solventborne paint, conduction charging is dominant for the applied voltage up to 80kV. For the same voltage and other parameters, waterborne paint has much larger total current and target current than solventborne paint. Target currents increase with paint flow rate, bell speed and shaping air flow rate, and decrease with bell-to-target distance. Since applied voltage and type of paint have the greatest effects on the current and thus the droplet charge-to-mass ratio, they need to be adjusted carefully during the painting process.

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<sup>\*</sup>Corresponding author