

Effects of Surface Roughness on Spangle Size and Crystallographic Texture of Hot-Dip Galvanized Steel Sheets

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Abstract Several challenges exist in hot-dip galvanized steel sheets, particularly in the automotive industry where spangle size must be reduced to below 100 μm to enhance anti-galling and gloss properties. Additionally, the strong (0001) basal texture of the zinc grains should be reduced to avoid coating delamination. Conventionally, imparting surface roughness to steel sheets has been known to reduce spangle size and (0001) basal texture of the zinc grains simultaneously. This study investigates how different types of surface roughness of steel sheets affect the spangle size and (0001) basal texture of GI (Zn-0.2wt.% Al) coatings. Prior to the hot-dipping process, the steel sheets were subjected to mechanical treatments to modify the surface roughness. First, both surfaces of the as-received SPM steel sheets were mirror-polished (MP) by buffing. The MP sheet surfaces were then either indented with various sizes or unidirectionally scratched using emery papers with different grit numbers. Comprehensive EBSD analyses demonstrated that the spangle size and (0001) basal texture of GI coatings strongly depend on the surface roughness of steel sheets, indicating that the indents on the steel sheet act as nucleation sites for Zn spangles. In the presentation, we will further discuss on the existence of a critical size for the indents to act as nucleation sites for Zn grains.

Keywords GI coating, spangle size, crystallographic texture, surface roughness, nucleation

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