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The Effect of Processing Variables on ZnMgAl Alloy Coating Characteristics

INTRODUCTION

With an increased need for press-shop efficiency in the automotive industry, TATA Steel has developed a ZnMgAl alloy coating which results in less galling and therefore decreased machine downtime. However, surface defects can occur more readily during the continuous galvanizing process, leading to aesthetic issues. This work examines the impact of coating weight on primary dendrite distribution.

EXPERIMENTAL

Samples of IF steel with various ZnMgAl coating weights were sequentially polished, allowing through-coating characterisation and phase volume fraction analysis (Figure 1-3). Coating thickness measurements were also taken to validate these results (Table 1).

RESULTS

Early findings show the volume percentage of primary zinc dendrites increases toward the centre of ZnMgAl coatings, regardless of coating weight (Figure 4). This can be explained by the nucleation and growth of the dendrites, which would begin near the steel and continue in a direction parallel to coating cooling.

FUTURE WORK

Ongoing research will aim to collect additional data from a wider range of samples and observe the effect of parameter changes in TATA Steel's ZODIAC galvanising line in Llanwern.

Table 1 – Coating thickness measurements taken with *Elcometer 355*

Sample	Coating Thickness (μm)		
	Min	Mean	Max
100g/m ²	5.80	8.40	11.70
140g/m ²	8.10	9.81	14.10
310g/m ²	21.80	25.07	30.00

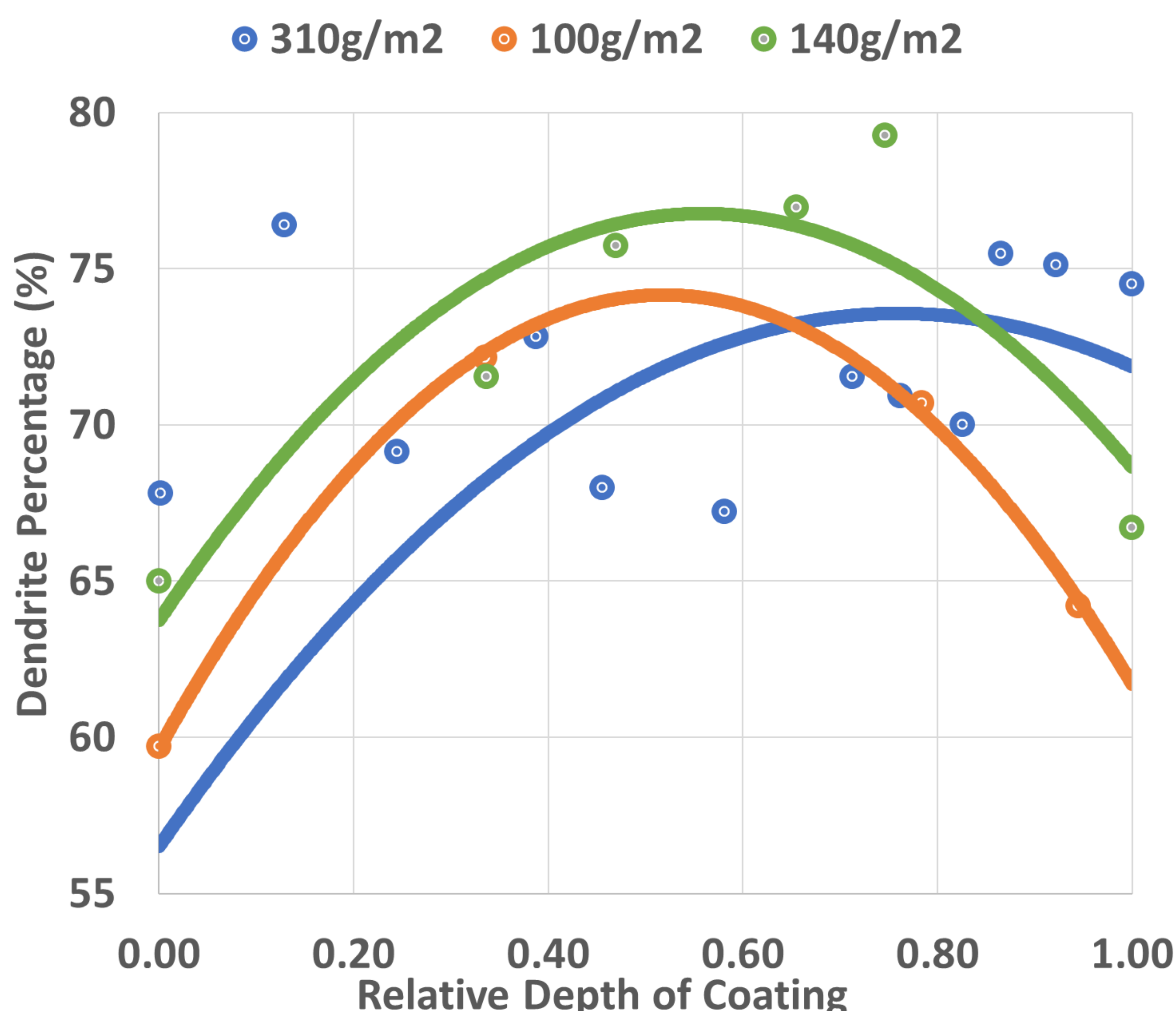


Figure 4 – Dendrite percentage at relative depth of coating, where '1.0' is within 1 μm of the substrate

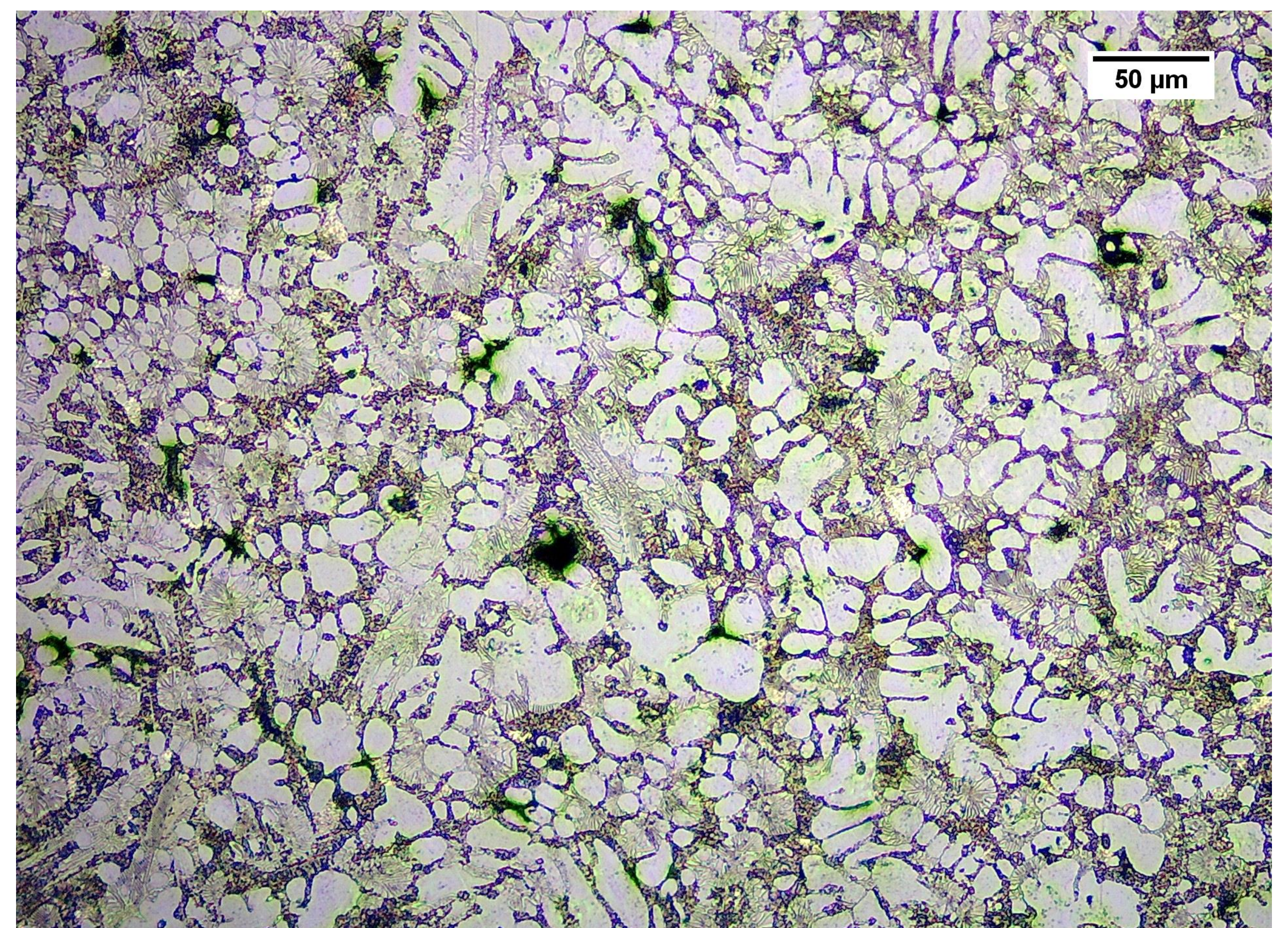


Figure 1 – 310g/m² Coating approximately 27.3 μm from substrate

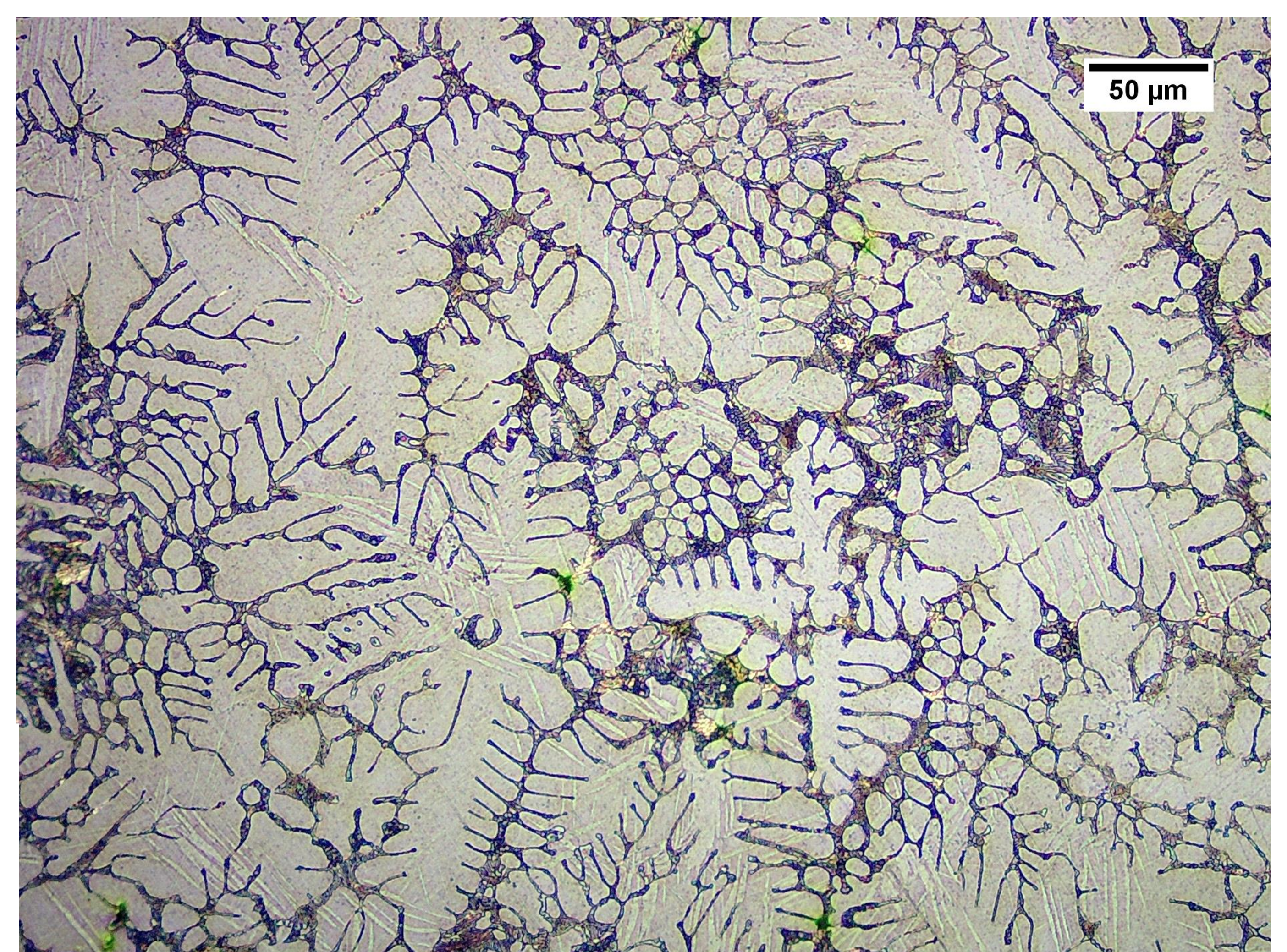


Figure 2 – 310g/m² Coating approximately 2.14 μm from substrate

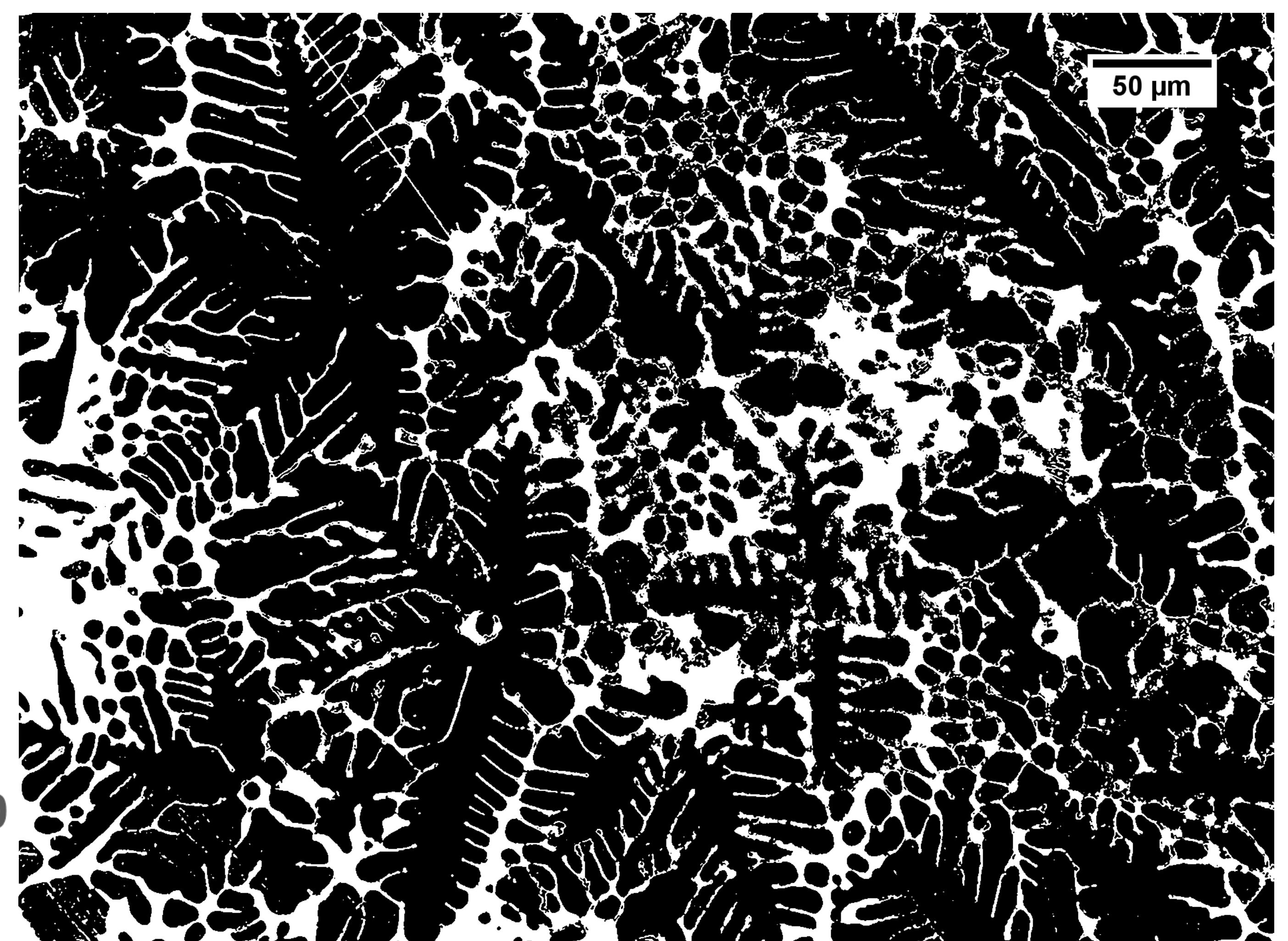


Figure 3 – ImageJ processing on 'Figure 2'