

MICRO-HARDNESS MAPPING OF HIGH PRESSURE DIE CAST Mg-AI BINARY ALLOYS

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- ❖ There is no agreeable definition or systematic study on the skin or the thickness effect of the skin in hpdc binary Mg-Al alloys
- ❖ The cross sectional grain microstructures and microhardness maps of circular and rectangular hpdc Mg-Al alloys, with varying thicknesses (1, 2 and 5mm) and compositions (0.5, 4, 9, and 12 mass % Al), were determined using a Philips XL30 Scanning Electron Microscope and a microhardness tester

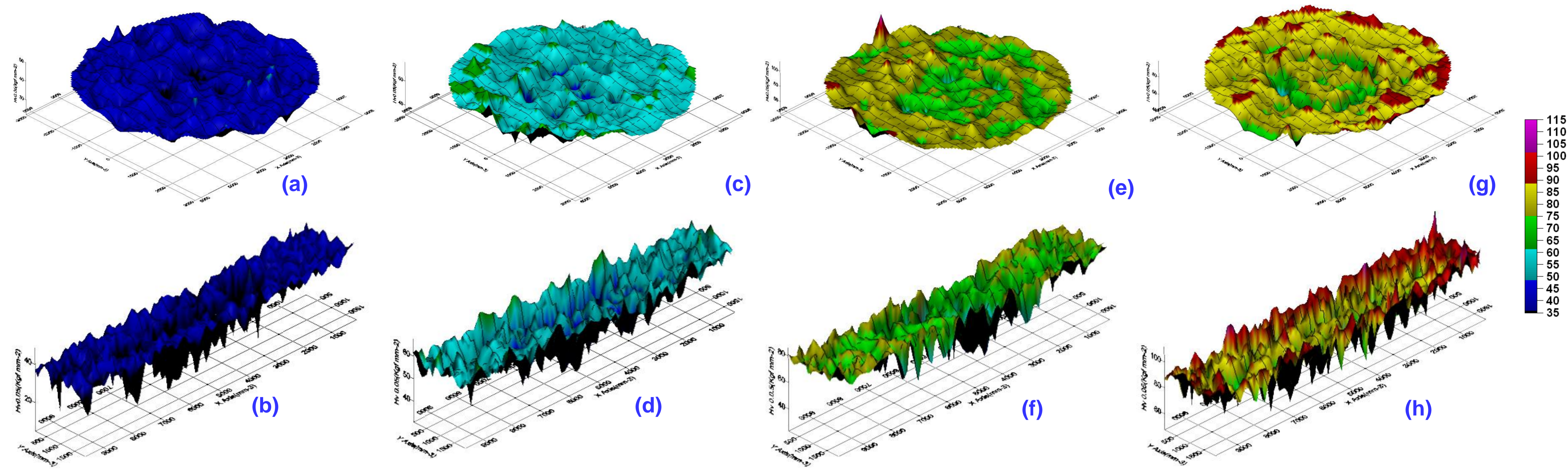


Figure 1. Microhardness profiles of circular and rectangular Mg-Al binary alloys with solute contents of (a, b) 0.5%Al, (c, d) 4%Al, (e, f) 9%Al, and (g, h) 12%Al.

The scattered distribution of large externally solidified grains and dispersed microporosity near the surface leads to a patchy, uneven, and asymmetric skin around the cross-section

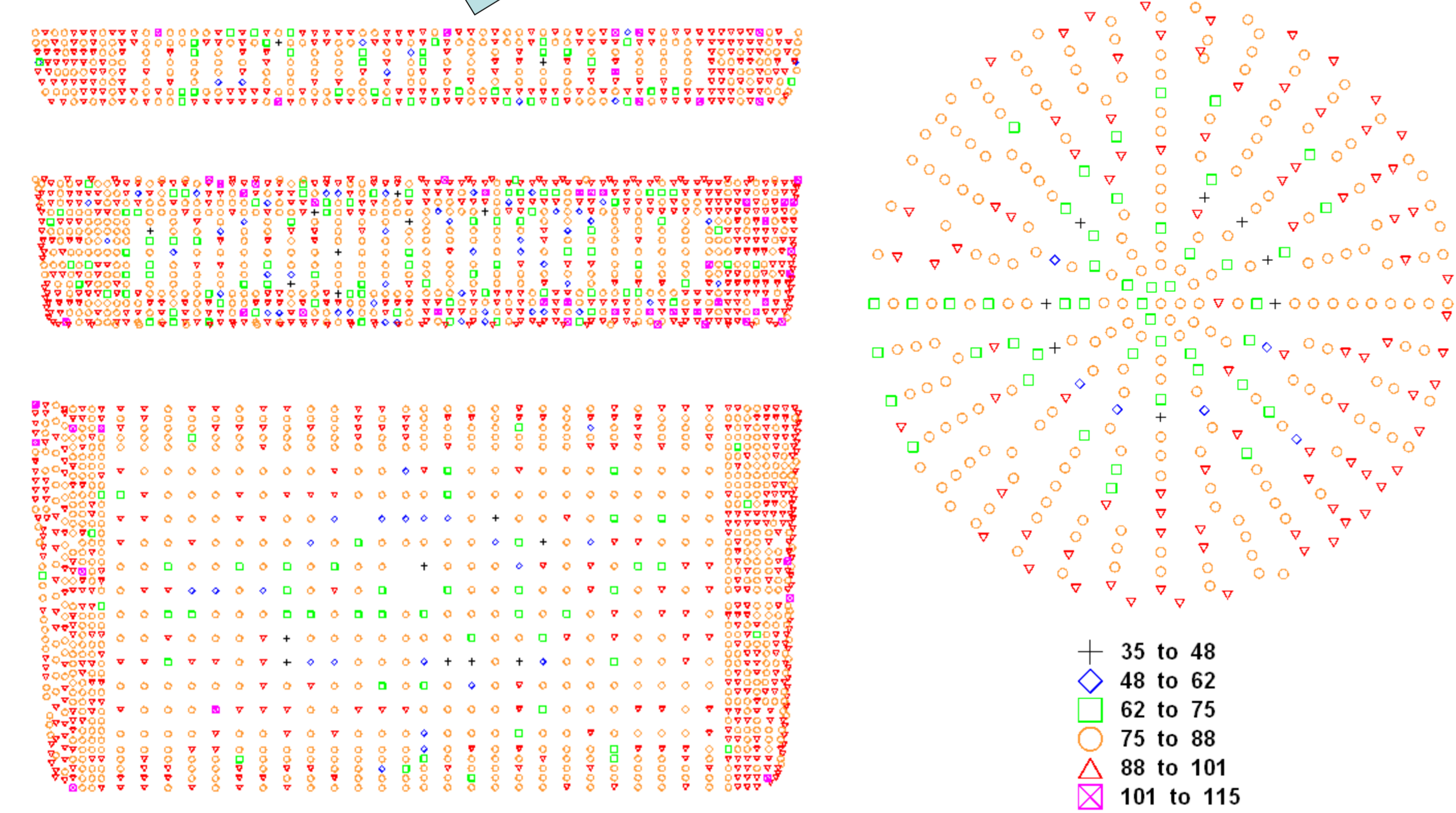


Figure 2. Microhardness post maps of Mg-12%Al alloy with rectangular (1, 2, and 5 mm thickness) and circular cross-sections.

With increasing the section thickness of the specimen, the trend to have well differentiated skin and core regions increases.

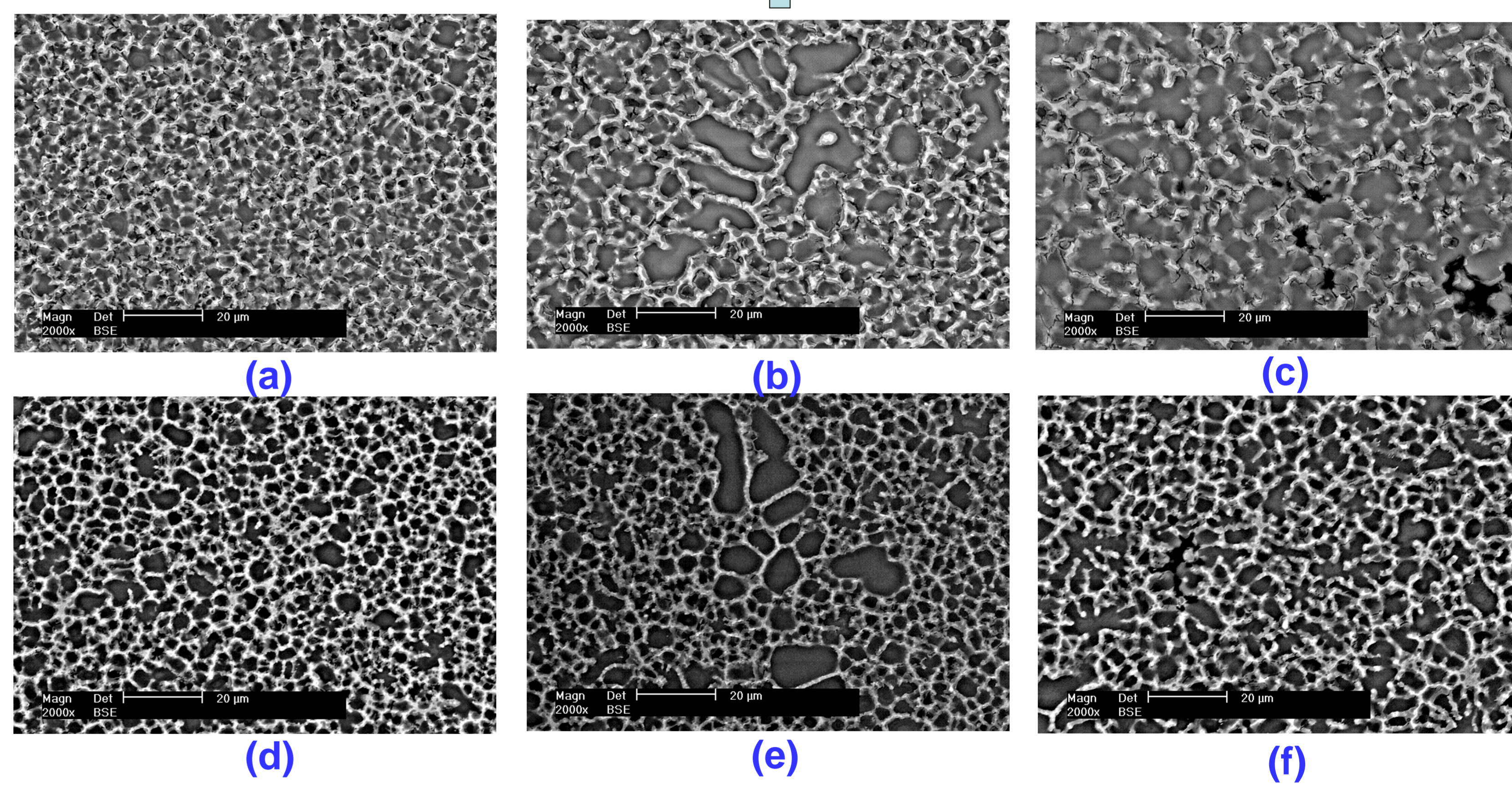


Figure 3. SEM back scattered electron images of Mg-12%Al alloy rectangular cross-section (a), (b) ~120 μm from the edge, (c) core region of 5 mm, (d), (e) ~120 μm from the edge, and (f) core region of 1 mm thick cross-section.

$$\begin{aligned} \sigma_{gb} &= \sigma_0 + k d^{-1/2} \rightarrow \Delta \sigma_{gb} = k(d_1^{-1/2} - d_2^{-1/2}) \\ H_v &= 0.38(YS + 45) \end{aligned} \quad \rightarrow \quad \Delta H_v = 0.38 k(d_1^{-1/2} - d_2^{-1/2})$$

Microhardness mapping of the whole cross-section provides a reliable way of describing the skin and generally the strength of the material across the entire section in high pressure die cast Mg-Al alloys.