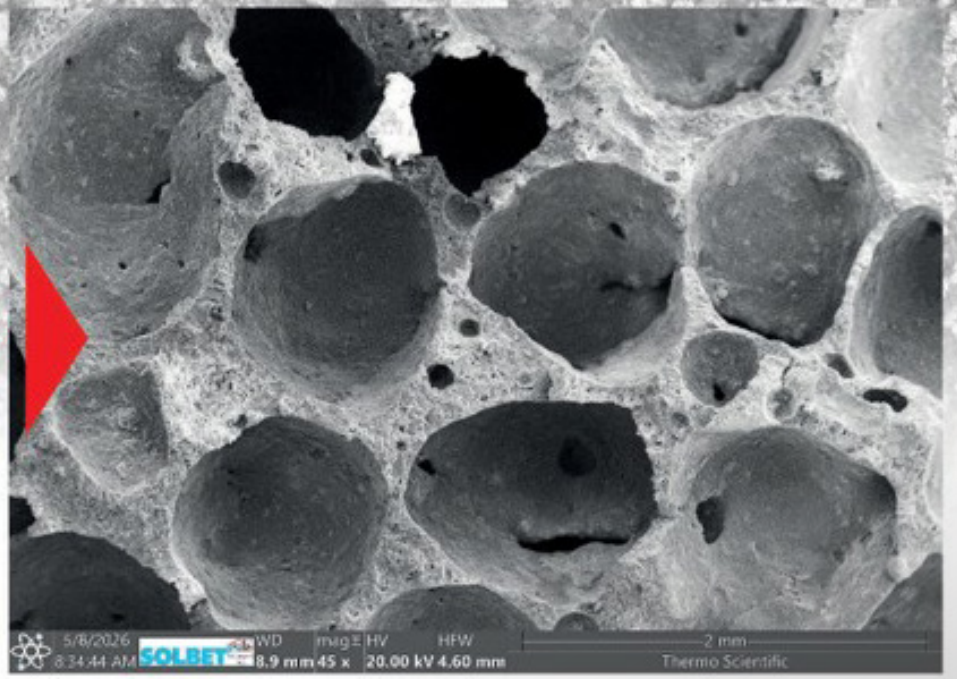
Calculating the formation of one macropore in AAC from on aluminium flake





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Calculation

Let's calculate this!

Assume that a single aluminum flake has a diameter of 50 µm and a thickness of 0.5 µm. These are average values, but they statistically correspond to a representative aluminum flake. The amount of hydrogen released from the active aluminum contained in such a flake, calculated under these assumptions, is VH2=0.00000384 cm³. This volume was calculated using the Clapeyron equation, V = nRT/P (PV = nRT).

Assuming a pore diameter of 1 mm, its calculated volume is Vpore= 0.0005235988 cm³. Of course, this is a highly averaged value adopted solely for the purpose of this comparison. The actual pore size distribution, depending on density classes and other parameters, is described in numerous publications.

For the purpose of this discussion, we also assume that no pressure is exerted by the AAC matrix on the gas trapped inside the pore. A matrix temperature of 45°C was also assumed in the alculations. Under these assumptions, approximately 136 flakes (Vpore/VH2) are required to form a single macropore (air pore). Even if the calculated pore volumes and hydrogen volumes are subject to some errors resulting from the simplifications adopted, we believe that the overwhelming majority of macropores (air pores) are formed through the coalescence of a larger number of small gas pores generated by the hydrogen released from individual aluminium flake.

As an aluminum powder supplier, we are frequently asked whether a single air bubble trapped in the AAC matrix, for instance, one with a diameter of 1.5 cm, could originate from a single aluminum flake (such as one resulting from a faulty milling process). Based on the calculations above, a flake with a thickness of 2 µm would need to have a diameter of 16.9 mm. A flake of this size is impossible to produce given current milling technology. Furthermore, an agglomerate of standard flakes (with a diameter of 50 µm) would have to consist of approximately 460,000 individual flakes. Based on this, in our view, large air bubbles are formed by entirely different processes rather than by reaction of single aluminum particles.

Of course, pore size distribution and its influence on AAC performance is a separate topic altogether, including AAC stability during rising, the formation of rising cracks, final compressive strength, thermal conductivity, and many other aspects.

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