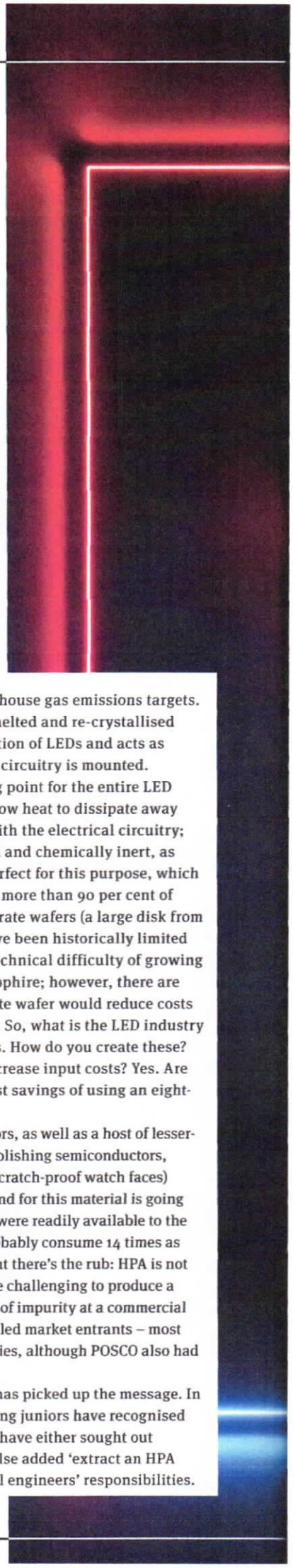

HPA

Can't illuminate it, can't illuminate without it

BY TOBY GREEN, SENIOR CONSULTANT, CRU GROUP

If any reader were to type high purity alumina (HPA) into their search engines, they would see that CRU Group has been highlighting some pretty remarkable demand growth prospects in this market for some time. I wrote my first published piece on this ceramic more than a year ago, and have been waiting ever since for either the penny to drop, or the hammer to fall – which is to say that either someone would step forward with a critical and heretofore unimagined piece of information that would discredit our analysis, or else a horde of investors would pile in to reap the benefits of the commodity growth story of the next decade. And yet, to date, neither of these has really happened. For a market that's driven by batteries and light-emitting diode (LED) lighting, it seems tough to develop a buzz or shine a light on it.

So, what have we learnt over the past year of examining the HPA market? In the most recent study CRU conducted – supporting Altech Chemicals through a financing exercise – we had an opportunity to take our level of coverage much deeper than we had previously, and to test our hypothesis that this material was highly sought after in lithium-ion batteries and LEDs.

In the former, HPA is used to either coat or impregnate the separators that stop the whole battery from short-circuiting: doing so roughly doubles the temperature that the separator can withstand. Now, this isn't particularly important, unless you were, say, fixated on increasing the energy density of the battery so that it carried more charge for its weight – essentially the main goal for all electric vehicle (EV) makers. The more energy you pack into a volume, the higher the temperatures involved: that is the entire principle that has driven an industry-wide shift towards ceramic-coated separators for EV applications. And while many producers have settled at present for a 99.9 per cent purity alumina that falls just shy of the threshold of 'HPA', it is nevertheless well known that the lower your impurities, the higher your battery cycle life and charge.

Meanwhile, on the lighting side, LEDs have continued to transform the global lighting market as part of ongoing efforts to reduce energy consumption – both for cost/energy savings and in order to meet greenhouse gas emissions targets. Synthetic sapphire (essentially a melted and re-crystallised form of HPA) is used in the production of LEDs and acts as the 'substrate' onto which the LED circuitry is mounted. This substrate is the direct starting point for the entire LED manufacturing process: it must allow heat to dissipate away from the diode, but not interfere with the electrical circuitry; ideally, it would be extremely hard and chemically inert, as well. Synthetic sapphire is near perfect for this purpose, which is why, to date, it has been used in more than 90 per cent of global LEDs. Moreover, most substrate wafers (a large disk from which individual LEDs are cut) have been historically limited to two-inch diameters due to the technical difficulty of growing and cutting a larger cylinder of sapphire; however, there are numerous reasons a larger substrate wafer would reduce costs in the LED manufacturing process. So, what is the LED industry calling for? Larger sapphire wafers. How do you create these? Start with purer HPA. Does this increase input costs? Yes. Are these more than covered by the cost savings of using an eight-inch wafer? Absolutely.

Our research into these two sectors, as well as a host of lesser-known uses of HPA and sapphire (polishing semiconductors, supporting catalysts, and creating scratch-proof watch faces) led us to only one conclusion: demand for this material is going up, and fast – very fast. In fact, if it were readily available to the market at any volume, we would probably consume 14 times as much of it in 2028 as we do today. But there's the rub: HPA is not 'readily available'. It is, in fact, quite challenging to produce a product with less than 0.01 per cent of impurity at a commercial scale, and history is littered with failed market entrants – most recently, Canada's Orbite Technologies, although POSCO also had a short-lived experiment in 2015.

All that isn't to say that no-one has picked up the message. In fact, a fair few mining and processing juniors have recognised the worthiness of this pursuit, and have either sought out appropriate mineral resources, or else added 'extract an HPA product' to the list of their chemical engineers' responsibilities.

Several projects now exist that are seeking to exploit kaolin aluminous clay – resources as a fairly easy precursor for HPA oduction – Altech Chemicals, FYI Resources, Gulf Minerals nd Andromeda Metals are among those based here in Australia. ill, others have begun to pursue HPA via a solvent extraction ocess, either as the main target or a by-product; again, Alpha PA and King River Resources are among the Antipodeans rsuing this model. In addition to the juniors, some of the major mmodity trading houses have begun to turn their attentions his niche market: most famously, Mitsubishi Corporation has ed a supply agreement with Altech Chemicals, but CRU is are of at least one other company of comparable scale that is nsidering a similar arrangement.

The first challenge, both for these producers and anyone considering a tilt at this fascinating market, is finding out whose process can be scaled up from laboratories and pilot plants into fully fledged commercial operations capable of supplying thousands of tonnes per annum of 99.99 per cent pure alumina to battery-makers and sapphire manufacturers. The second will be finding consumers in China, Japan and South Korea who trust the quality and consistency of their product – no mean feat, given how many have been mis-sold lower-quality material in the past.

Any producer who can successfully jump these hurdles, however, is sure to be well rewarded, with achievable prices currently at almost double the cost of production – and trending up. If you are looking for a new show, this is one to watch. AR&I