The Case for Critical Minerals versus Military Metals

written by Jack Lifton | August 12, 2024

I don’t remember the exact date I first heard that “rare earths are critical for the military,” but it was before 2010, and the source was the advertising (aka announcements) coming from the then newly revived Molycorp, the anchor company of the then-burgeoning rare earth boom. I cannot recall any confirmation of that statement by the U.S. Dept of Defense until recently, but I do recall a 2013 paper coming out of the D.C. bureaucracy stating that “military demand” was “about” 1000 tons per year of “rare earth permanent magnets.”

When the Defense Logistics Agency (DLA) approached me in the mid-teens to design a protocol for recycling rare earth permanent magnets (REPMs) the task was shrouded in secrecy. I was specifically asked to focus on the overwhelmingly common neodymium-iron-boron type, and when I inquired about the volume demand, I was met with a curt ‘classified.’ This confidentiality, while rendering the project commercially meaningless, was of no concern to the DLA.

In the course of my travels then, I was giving an invited talk in France, and I was asked by the French government entity, CEA, the nuclear fuel reprocessor, to visit their installation at Mercule, near Avignon, to learn, as they told me, the best ways to separate the rare earths. During my visit, I learned that CEA’s scientists, just like the Americans at Oak Ridge, TN, had been using the lanthanides to model processes for separating and purifying the actinides, which were all too dangerously radioactive for cost-effective laboratory research and development.

Anyway, between the solvent extraction expertise of CEA and the continuous ion chromatography, CIC, skills of the private American company, K-Technologies, Inc., I soon had two types of technologies to cost out to separate the rare earths. As it turned out, if and only if, the feedstock was assumed to be a clean (of interfering elements) PLA (pregnant leach solution) then the CIC won out, based on CAPEX and OPEX. The “front end” of the project, the acquisition and chemical processing of the feedstocks, were not discussed or costed out. But the “front end” was the issue.

The problems turned out to be, as they are in ALL recycling programs, sourcing and “preparing” the scrap economically enough so that the end products could be produced profitably. For the DLA the chokepoint was sourcing. I was told that it was impossible to simply look for the military uses of rare earth permanent magnets and then develop protocols to remove the necessary components from the scrap streams and separate the magnets, because the information as to their locations was “classified’ and distributed among a myriad of agencies and contracts.

As I look back upon this project, the most amazing thing is that we never discussed samarium cobalt REPMs, which are the most used REPMs by the US Air Force, which was then the primary source of REPM demand by the military.

At no time during my work with the DLA did anyone say that the U.S. military depended upon REPMs for their effectiveness. The issue was to use military scrap as a secure backup source of rare earths in case we were cut off by the primary supplier, China. This is called supply risk management at the Harvard Business School.

Just in the last few years, the U.S. military has engaged in the

necessary planning and finance to develop a domestic source of REPMs for its own use. This has required it to choose vendors for a total DoD focused domestic supply chain for REPMs. It has chosen as its primary source of light magnet rare earths, Lynas Rare Earths Ltd. (ASX: LYC), which has been funded to build an SX-based rare earth separation plant in Texas of sufficient size to meet DoD needs and to use its own Australian ore concentrates for that purpose. The DoD has also selected MP Materials Corp. (NYSE: MP) as a backup source. The DoD has been assured by both Lynas and MP that they can also provide heavy rare earth ore concentrates and so the DoD funding includes $39 million for MP to engineer a heavy rare earths separation/purification system as an "add on" or free-standing addition to its existing SX system.

I don't know what the DoD plans to do to solve the problem of the lack of RE metal and alloying operations in the USA.

I do know that the DoD has chosen the (formerly[?]) German company Vacuumschmelze (Vac) to produce its neodymium-iron-born type magnets. The DoD has given $95 million to that company to build a (dedicated to the DoD?) REPM manufacturing facility in Summit, South Carolina. I do not know if Vac has also been tasked to build samarium cobalt REPMs, but I do know that Lynas current processing residues, which at full (Malaysian sited) production cumulate to 4000 tons per year have 48% samarium content. The DoD has also funded proof of concept studies for both the RapidSx rare earth separation/purification systems of Ucore Rare Metals Inc. (TSXV: UCU | OTCQX: UURAF) and the electrochemical rare earth separation technology of Rare Earth Salts, of Nebraska.

MP is building a REPM manufacturing facility in Fort Worth, Texas, but I don't know if the DoD plans to use it as a backup to Vac or as a source of REPM metals and alloys.

In my opinion, the U.S. military demand for REPMs of the neodymium-iron-boron type is small in comparison to the overall U.S. consumer products demand, but for samarium cobalt it is the overwhelming end-user. Therefore the U.S. DoD demand is not an important factor in the overall demand for NdFeB REPMS!

And, the funding from the DoD for REPMs should not be used as a benchmark for the civilian market.

The DoD has a deadline for eliminating ALL Chinese content from its supply chains.

The DoD currently buys components with rare earth content, which is mainly sourced from or processed in China.

That deadline is the driver for the DoD's interest in a total domestic American supply chain for REPMs.

I suspect that it will not be met, but will be said to have been fulfilled by the usual chicanery, including the Commerce Department's listing of Belgium as a major source of rare earth products.

Private equity and private industry investments in a REPM supply chain seem to rely heavily on the so-called military importance of and necessity for REPMs

In fact, the most important, and, by far, the largest use of REPMs of the NdFeB type is the efficient operation of battery-powered and hybrid vehicles.

The OEM non-Chinese automotive industry has and is now making choices of REPM suppliers that are non-Chinese.

Let's hope they ignore the machinations of the results-only decisions of the DoD and choose wisely.