Valuable, rare, raw earth materials extracted from industrial waste stream

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Fierce competition over raw materials for new green technologies could become a thing of the past, thanks to a discovery by scientists from the University of Leeds.

Researchers from Leeds' Faculty of Engineering have discovered how to recover significant quantities of rare-earth oxides, present in titanium dioxide minerals. The rare-earth oxides, which are indispensable for the manufacture of wind turbines, energy-efficient lighting, and hybrid and electric cars, are extracted or reclaimed simply and cheaply from the waste materials of another industrial process.

If taken to industrial scale, the new process could eventually shift the balance of power in global supply, breaking China's near monopoly on these scarce but crucial resources. China currently holds 95 per cent of the world's reserves of rare earth metals in a multi-billion dollar global market in which demand is growing steadily.

"These materials are also widely used in the engines of cars and electronics, defence and nuclear industries. In fact they cut across so many leading edge technologies, the additional demand for device related applications is set to outstrip supply," said Professor Animesh Jha, who led the research at Leeds.

"There is a serious risk that technologies that can make a major environmental impact could be held back through lack of the necessary raw materials - but hopefully our new process, which is itself much

'greener' than current techniques, could make this less likely."

Despite their name, the fifteen rare earth metals occur more commonly within the Earth's crust than precious metals such as gold and platinum, but their oxides are rarely found in sufficient concentrations to allow for commercial mining and purification. They are, however, found relatively frequently alongside titanium dioxide - a versatile mineral used in everything from cosmetics and medicines to electronics and the aerospace industries, which Professor Jha has been researching for the last eight years.

The Leeds breakthrough came as Professor Jha and his team were fine-tuning a patented industrial process they have developed to extract higher yields of titanium dioxide and refine it to over 99 per cent purity. Not only does the technology eliminate hazardous wastes, cut costs and carbon dioxide emissions, the team also discovered they can extract significant quantities of rare earth metal oxides as co-products of the refining process.

"Our recovery rate varies between 60 and 80 per cent, although through better process engineering we will be able to recover more in the future," says Professor Jha. "But already, the recovery of oxides of neodymium (Nd), cerium (Ce) and lanthanum (La), from the waste products - which are most commonly found with titanium dioxide minerals - is an impressive environmental double benefit."

Provided by University of Leeds