Poster | Raw materials

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[P2] Raw Materials & Recycling

Session Chair: Mr. Johann Fischbacher (University for Continuing Education Krems, Austria), Dr. Yusuke Hirayama (AIST, Japan)

[P2-29] Recycling of NdFeB magnets from hard disc drive scrap using HPMS and using recycled magnets in an automotive auxiliary motor

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Rare earth elements are at the top of the list of critical elements for the UK, EU, and US due to their use in the green energy transition [1-3]. Rare earths such as neodymium; are used to make the strongest permanent magnets known as neodymium-iron-boron (NdFeB) magnets. NdFeB magnets are commonly found in consumer electronics such as hard disc drives (HDDs), smartphones and loudspeakers. They also play a vital role in green technologies such as hybrid, electric vehicles and wind turbines. In recent years, the increasing popularity of electric cars and wind turbines has caused an increase in the demand for these magnets, leading to supply and price volatility risks.

The scrap containing NdFeB magnets can be a valuable resource to generate an additional supply to meet the growing demand. However, there are challenges surrounding the collection and segregation of scrap containing these magnets, recovery of the alloy powder with minimal contamination and cost-effective re-processing into new magnets. Previous work has shown that by using the hydrogen processing of magnetic scrap (HPMS) technology, NdFeB magnets from HDDs, automotive scrap and loudspeakers can be removed in the form of demagnetised powder and re-sintered into new magnets post-purification [4-6].

In this work, 100 kg of mixed source separated voice coil magnet assemblies (VCM) from HDDs were processed in the commercial HPMS vessel at 2 bar hydrogen pressure at room temperature. The composition of the liberated material was analysed showing 0.343 wt.% oxygen, 0.118 wt.% carbon and 0.45 wt. % nickel. The powder was sieved below 90 µm to remove the nickel coating and the purified powder was subsequently partially degassed, jet-milled, aligned, compacted and sintered at 1070 ^{o}C for 4 hours with the addition of 3 wt.% NdH_3. The resulting recycled magnets had B_r of 1.34 T and H_{cj} of 1279 kA/m and showed 0.159 wt.% oxygen, 0.119 wt.% carbon and 0.028 wt.% nickel.

The recycled magnets were machined to size and installed in an existing automotive auxiliary motor design. No changes to the motor design were made to adapt for use of

recycled magnets. The motor showed performance within 3% of the minimum acceptable.

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