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Spectroscopic insights into the electronic structure of non-critical rare earth containing permanent magnets

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The extensive use of critical rare-earth elements like Nd and Sm in magnet production raises concerns about their limited availability [1]. Ongoing research explores the feasibility of cost-effective hard magnetic materials by substituting Nd or Sm with more abundant rare-earth elements such as Ce or La [2]. Here, it is crucial to deepen our understanding of the electronic and magnetic structures of compounds consisting of these low-cost rare-earth elements.

Here, we study the role of Ce as a candidate to replace heavy RE elements by investigating its 4f/5d valence state in different Ce-substituted permanent magnet systems. X-ray absorption spectroscopy was performed on Ce-Co, Ce-Co-Zn, and Ce-Co-Cu systems with varying compositions, examining the respective K, $L_{2,3}$, and $M_{4,5}$ edges of their components. We correlate the spectroscopically determined Ce valence with the composition and magnetic properties to understand the influence of Ce content on their magnetic properties.

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[2] K. P. Skokov et al. Scripta Materialia, 154, 289-294 (2018)

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