Characterization of vanadium in slags and redox flow batteries

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Vanadium is a highly redox active element. It can be present in slags in rather high concentrations. In the pentavalent state is an environmentally harmful species. Vanadium is also a valuable alloy metal. Therefore, vanadium in slags can pose a problem or be an opportunity. If vanadium can be enriched in a certain mineralogical compound via slag modification, the separation of this compound would deliver a vanadium concentrate on the one side and a vanadium-free slag for deposition on the other side. The determination of the elemental composition and of the oxidation state of the vanadium bearing phases is crucial to understand the nature of this element in slags. Eventually, this will help to develop a knowledge based procedure for the recycling of vanadium rich slags.

The redox activity of vanadium is also key to the function of Vanadium Redox Flow Batteries (VRFB) a promising candidate to store energy from renewable sources. In VRFBs vanadium occurs in the oxidation states II, III, IV and V. The species are converted into each other during the operation of the battery. Unfortunately, a major capacity decay is correlated to the unwanted transport of the vanadium-species through the separator an ionomeric membrane. The transport through the nanoscopic water system of these two-faced materials (having hydrophilic and hydrophobic characteristic) is in general lacking understanding.

Here, we present first results on vanadium elemental determination and speciation in slags and VRFBs.