IN-SITU XAS MEASUREMENTS OF VANADATE-PHOSPHATE GLASSES

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The rapid growth of renewable energy production is an undeniable reality of the modern world. However, a major limitation of these energy sources is their strong dependence on weather conditions, which significantly reduces their reliability. This challenge necessitates the use of energy storage systems, such as batteries, to stabilise the power grid during unfavourable weather conditions or periods without sunlight.

Vanadate phosphates constitute a broad class of materials that are considered promising cathode candidates for lithium-ion batteries and have therefore been extensively investigated. Notable examples include crystalline $VOPO_4$ [1] and $Li_3V_2(PO_4)_3$ [2]. Our group has also focused on glassy vanadate–phosphate systems, demonstrating that controlled thermal nanocrystallisation can substantially enhance their electronic conductivity. For example, 90 V_2O_5 ·10 P_2O_5 glasses initially exhibit an electrical conductivity of approximately $\sigma = 7 \times 10^{-5}$ S/cm, which increases dramatically to $\sigma = 7 \times 10^{-2}$ S/cm at room temperature following nanocrystallisation [3]. Despite this significant improvement, the underlying mechanism responsible for the conductivity increase during crystallisation is not fully understood yet.

The aim of this study was to investigate the structural and electronic changes occurring in vanadate–phosphate glasses during heating from room temperature to temperatures well above the crystallisation point. For this purpose, in situ X-ray Absorption edge Spectroscopy (XAS) measurements were performed. This technique provides valuable insight into the evolution of both the local atomic and electronic structures during the crystallisation process. Results of this measurement as well as methodology will be presented.

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