# TOWARDS HIGHLY CONDUCTIVE NANOCRYSTALLISED VANADATE-PHOSPHATE GLASSES

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In the last few decades, the growth of renewable power sources has been observed. Unfortunately, those power sources are heavily dependent on weather conditions. For this reason, battery systems are needed for power grid stabilization.

Vanadate-phosphate is a wide group of materials, and it has a long history of research and development. Crystalline $VOPO_4$ was investigated by e.g. M. S. Whittingham's team [1], $Li_3V_2(PO_4)_3$ was studied by e.g. L. F. Nazar's team [2]. However, corresponding glasses, including vanadate-phosphates, were at the edge of mainstream researches. E.g., 90 $V_2O_5 \cdot 10\ P_2O_5$ glasses and nanomaterials were studied by T. K. Pietrzak's team [3, 4]. Glassy material has conductivity around $\sigma = 7 \cdot 10^{-5}$ S/cm but after nanocrystallization the electronic conductivity dramatically increased to the level of $\sigma = 7 \cdot 10^{-2}$ S/cm at room temperature. Moreover, gravimetric capacity was also determined for this highly conductive material and it was at the level of 225 mAh/g in first cycle (C/20 current), but it dropped to 140 mAh/g in the third cycle.

The objective of this work is to synthesise a glassy analogue of 95 $V_2O_5 \cdot 5\ P_2O_5$ (i.e., with a higher content of vanadium) and optimize its electronic conductivity. For this purpose, many different measurement methods were used: XRD, SEM and EDX to confirm the glassy state, shape of the surface and to determine percentage of impurities, DSC to check glass thermal stability, and DC for electrical measurements. With this method, changes in material during heat treatment can be described, and correlations between changes in conductivity and other structural factors will be shown.

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