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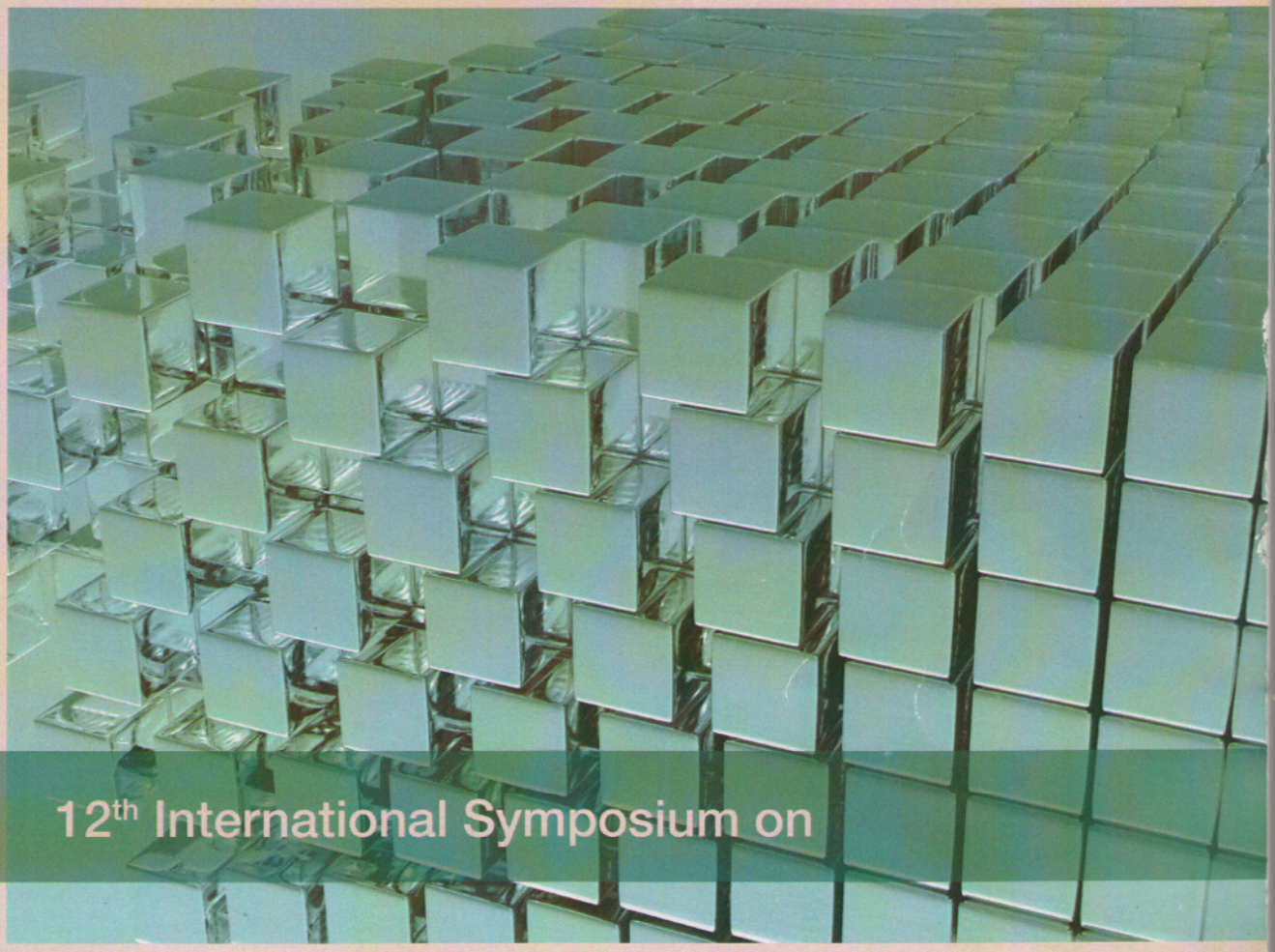

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Program and abstracts

Anomalous Temperature Dependences of $Na_2MnP_2O_7$ Electrical Properties

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Abstract

$Na_2MnP_2O_7$ was proposed as a potential candidate for sodium-ion battery cathode [1]. Its structure and electrochemical properties were studied previously [2], however, all the investigations on this compound were only performed at room temperature. In the current work we study high temperature behavior of $Na_2MnP_2O_7$ powders and ceramics.

$Na_2MnP_2O_7$ was synthesized by solid state reaction. X-ray powder diffraction (XRPD) showed the triclinic symmetry of the compound (space group P1), identical to the one obtained in [2]. Differential thermal analysis clearly showed an endothermic peak at 670 K on heating the powder and an exothermic peak on cooling down. This suggested a structural phase transition of $Na_2MnP_2O_7$ and it was confirmed by thermal XRPD.

Impedance spectroscopy of the sintered $Na_2MnP_2O_7$ ceramics was performed in the frequency range of 10 Hz – 3 GHz and 300-700 K temperature interval. Surprisingly, a significant decrease of conductivity was observed up to 340 K. It was shown, that a very small amount of water in the sodium-manganese-pyrophosphates affects their room temperature conductivity, which must be mixed Na^+ and protonic at the same time. At 670-680 K, a sharp increase of conductivity and dielectric permittivity was associated with a phase transition taking place in $Na_2MnP_2O_7$. The anomalous change of electrical parameters at the phase transition temperature was frequency independent.

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[1] V. Palomares, et al., Energy Environ. Sci., 6 (2013) 2312.
[2] P. Barpanda, et al., Journal of Materials Chemistry A, 1 (2013) 4194.

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