

Possible Evidence For "Paddle Wheel Mechanism" for Ionic Transport in α -Li₂SO₄

M.A. Careem, M.A.K.L. Dissanayake, P.W.S.K. Bandaranayake & C.N. Wijayasekara
Department of Physics, University of Peradeniya, Peradeniya.

α -Li₂SO₄ is a stable solid electrolyte above 577⁰C with a high ionic conductivity of the order of 1 ohm⁻¹cm⁻¹. This high conductivity may be attributed to an unusual transport mechanism called "paddle wheel mechanism" where the mobility of the Li⁺ ions is strongly enhanced by the partial rotational motion of the transitionally static sulphate ions (1). The effect on the ionic conductivity of α -Li₂SO₄ on adding small amounts of Li₂WO₄ was investigated by measuring the electrical conductivities of various compositions of Li₂SO₄ + Li₂WO₄ system at temperatures above 577⁰C using the U-cell technique. The electrical conductivities for compositions with 2-2.5 mole percent of Li₂WO₄ within the solid solubility region in the α -phase were found to be slightly lower than those of pure α -Li₂SO₄ at corresponding temperatures. This is in contrast to the conductivity enhancement observed in the same system in the monoclinic β -phase at temperatures below the phase transition (2). The lowering of the ionic conductivity of α -Li₂SO₄ due to Li₂WO₄ doping can be interpreted in favor of the 'paddle wheel' type of mechanism for the high ionic transport in α -Li₂SO₄.