Ternary lithium manganese (II) chloride as a new red-emitting neutron scintillator

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Neutron detectors play an important role in many application fields, such as nuclear power generation, nuclear decommissioning and decontamination, border and homeland security control, nuclear non-proliferation and medicine [1,2]. The current world source of ^{3}He comes mostly from the decay of tritium originating in nuclear weapons programs in the U.S. and Russia. Since 2008, ^{3}He has become extremely expensive as the supply became limited and the world has been facing the shortage [1,3]. As ^{3}He proportional counters still represent the industry standard for neutron detection [4,5], there is still high demand for an alternative scintillation material, which would have potential to be mass-produced at low-cost from promptly available materials and technology [3]. Good neutron detection efficiency, gamma-neutron separation and robustness for deployment are the most important properties sought after [1].

From the group of inorganic scintillators, red-emitting ternary lithium manganese (II) chloride (Li_2MnCl_4) could represent a promising new material for neutron detection. In this study, undoped and Ce^{3+} and Eu^{2+} doped Li_2MnCl_4 single crystals were grown by vertical Bridgman method and basic structural, compositional, physical, thermal, optical, luminescence, and scintillation characterizations were performed.

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