Preparation of Nano-Scaled \textit{linbo3} by Polyol Method

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Abstract: The growth of optical LiNbO$_3$ single crystal and its physical and chemical properties are well known on the macroscopic scale. Nowadays the rare-earth doped single crystals became important for coherent quantum optical experiments: electromagnetically induced transparency, slow down of light pulses, coherent quantum memory. The expansion of applications is increasingly requiring the production of nano scaled LiNbO$_3$ particles. For example, rare-earth doped nanoscaled particles of lithium niobate can be act like single photon source which can be the bases of a coding system of the quantum computer providing complete inaccessible to strangers. The polyol method is a chemical synthesis where oxide formation occurs instead of hydroxide because of the high temperature. Moreover the polyol medium limits the growth and agglomeration of the grains producing particles with the diameter of 30-200 nm. In this work nano scaled LiNbO$_3$ was prepared by the polyol method. The starting materials (niobium oxalate and LiOH) were diluted in H$_2$O$_2$. Then it was suspended in ethylene glycol and heated up to about the boiling point of the mixture with intensive stirring. After the thermal equilibrium was reached, the mixture was kept in this temperature for 4 hours. The suspension was cooled overnight. The mixture was centrifuged and the particles were filtered. Dynamic Light Scattering (DLS) measurement was carried out and the size of the particles were found to be 80-100 nm. This was confirmed by Scanning Electron Microscope (SEM) investigations. The element analysis of SEM showed large amount of Nb in the sample. The production of LiNbO$_3$ nano particles were succesful by the polyol method. The agglomeration of the particles were avoided and the size of 80-100nm could be reached.

Keywords: lithium-niobate, nanoparticles, polyol, SEM

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