The feasibility of growing alkali halides in the hypothetical 5-5 structure type on a specially prepared substrate of LiNbO$_3$ has been investigated. The highest degree of steering towards this structure is achieved by growing NaBr on a LiNbO$_3$ (001)-surface, where the outermost layer of oxygen atoms is followed by a layer of niobium atoms. The kinetic stability, against transition into the rock salt structure, of the 5-5 structure grown on the substrate is enhanced compared to the bulk 5-5 phase, but the 5-5 structure will nevertheless still be metastable compared to the rock salt structure type that constitutes the thermodynamically stable bulk phase of NaBr under standard conditions.

**Key words:** Halides, Lithium Niobate, Surface Energies, Wulff Construction, Metastable Phases