Room temperature ferromagnetism and lack of ferroelectricity in thin films of 'Biferroic?' YbCrO3

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Abstract: Search for novel multi-functional materials, especially multiferroics, which are ferromagnetic above room temperature and at the same time exhibit a ferroclectric behavior much above room temperature, is an active topic of extensive studies today. Ability to address an entity with an external field, laser beam, and also electric potential is a welcome challenge to develop multifunctional devices enabled by nanoscience. While most of the studies to date have been on various fomis of Bi- and Ba based Ferrites, rare earth chromites are a new class of materials which appear to show some promise. However in the powder and bulk form these materials are at best Danted antiferromagnets with the magnetic transition temperatures much below room temperaLure. In this presentation we show that thin films of YbCrO3 deposited by Pulsed Laser Deposition exhibit robust ferromagnetic properties above room temperature. It is indeed a welcome surprise and a challenge to understand the evolution of above room temperature ferromagnetism in such a thin film. The thin films are amorphous in contrast to the powder and bulk forms which are crystalline. The magnetic properties are those of a soft magnet with low coercivity. We present extensive investigations of the magnetic and ferroelectric properties, and specti-oscopic studies using XAS techniques to understand the electronic states of the constituent atoms in this novel Chromite. While the amorphous films are ferromagnetic much above room temperature, we show that any observation of ferroelectric property in these films is an artifact of a leaky highly resistive material.

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