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Thermodynamics of Ferroelectric Crystals with Domains

Long-Qing Chen
The Pennsylvania State University

陈龙庆博士，现任宾夕法尼亚州立大学材料科学与工程Donald W. Hamer教授、工程科学与力学教授和数学教授，于2023年当选欧洲科学院外籍院士。1982年获得浙江大学学士学位；1985年硕士毕业于纽约州立大学石溪分校；1990年获得麻省理工学院博士学位。他的主要研究聚焦于理论和计算模型的开发，并运用于探索铁电氧化物、结构金属合金以及2D、量子和能源材料中的相变和微观结构发展。曾在 *Nature*、*Science*及*Nature Materials*等学术期刊上发表论文800余篇，H因子达135。陈龙庆教授曾先后获得材料研究学会材料理论奖、古根海姆奖学金、洪堡研究奖、TMS John Bardeen奖和IEEE-UFFC-S杰出讲座奖，是TMS、MRS、AAAS、APS、ASM和ACerS等国际学会会士。

Abstract: The lecture discusses the thermodynamics and the phase-field method of ferroelectric crystals and their applications to modeling and predicting the stability of domain structures and their responses to mechanical and electric fields. It will start with the basic principles of classical thermodynamics by introducing a modern version of the first law of thermodynamics and apply it to obtain the fundamental equation of thermodynamics for homogeneous ferroelectric crystals. The relations of the fundamental equations of thermodynamics, Landau theory of ferroelectrics, and the thermodynamic properties will then be discussed, including the dielectric, elastic, piezoelectric properties. It will then be followed by the discussion on the thermodynamics of inhomogeneous ferroelectric crystals containing domain structures involving long-range elastic and electrostatic interactions and domain wall energy. The contributions to thermodynamics from electronic and ionic defects will be briefly discussed. The last part of the lecture will be focused on the applications of the phase-field method of ferroelectric domain structures. Examples will be presented to illustrate the application of the phase-field method to interpreting and understanding experimentally observed ferroelectric domain structures and to providing guidance to experimental growth of thin films and characterization to discover new mesoscale domain states of materials, achieve dramatically enhanced properties, and uncover hidden functionality.

报告时间: 2024年5月16日 14:00 ~ 16: 00

报告地点: 嘉定园区G楼G4第一会议室

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