Dielectric, Ferroelectric, and Optical Properties

Susanne Hoffmann-Eifert, Peter Grünberg Institute & JARA-FIT, Forschungszentrum Jülich, Germany

Dieter Richter, Jülich Centre for Neutron Science & Institute for Complex Systems, Forschungszentrum Jülich, Germany

Susan Trolier-Mc Kinstry, MATSE Department, Pennsylvania State University, USA

Content

1 Introduction ........................................ 35

2 Polarization of Condensed Matter ........ 35
2.1 Electrostatic Equations with Dielectrics 36
2.2 Microscopic Approach and the Local Field 36
2.3 Mechanisms of Polarization ................. 37
2.4 The Complex Dielectric Permittivity .... 37
2.5 Spontaneous Polarization .................. 38

3 Polarization Waves in Ionic Crystals .... 41
3.1 Acoustic and Optical Phonons ............ 41
3.2 Polaronics ....................................... 42
3.3 Consequences of the Concept of Polaritons 44
3.4 Characteristic Oscillations in Perovskite-type Oxides 45

4 Ferroelectrics .................................... 46
4.1 Ginzburg-Landau Theory .................... 46
4.2 Soft Mode Approach of Displacive Phase Transition 49
4.3 Ferroelectric Materials ..................... 49
4.4 Ferroelectric Domains ...................... 50

5 Optical Properties .............................. 54
5.1 Propagation of Electromagnetic Waves in Condensed Matter 54
5.2 Transmission of Electromagnetic Waves 56
5.3 Interaction of Light with Matter .......... 58

6 Closing Remarks ................................. 59