

# 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

<b>1 Introduction</b>	35
<b>2 Polarization of Condensed Matter</b>	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
<b>3 Polarization Waves in Ionic Crystals</b>	41
3.1 Acoustic and Optical Phonons	41
3.2 Polaritons	42
3.3 Consequences of the Concept of Polaritons	44
3.4 Characteristic Oscillations in Perovskite-type Oxides	45
<b>4 Ferroelectrics</b>	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
<b>5 Optical Properties</b>	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
<b>6 Closing Remarks</b>	59

