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Much of the recent progress in the solid Earth sciences is based on the interpretation of a range of geophysical and geological observations in terms of the properties and deformation of Earth materials. One of the greatest challenges facing geoscientists in achieving this lies in finding a link between physical processes operating in minerals at the smallest length scales to geodynamic phenomena and geophysical observations across thousands of kilometers.

This graduate textbook presents a comprehensive and unified treatment of the materials science of deformation as applied to solid Earth geophysics and geology. Materials science and geophysics are integrated to help explain important recent developments, including the discovery of detailed structure in the Earth’s interior by high-resolution seismic imaging, and the discovery of the unexpectedly large effects of high pressure on material properties, such as the high solubility of water in some minerals. Starting from fundamentals such as continuum mechanics and thermodynamics, the materials science of deformation of Earth materials is presented in a systematic way that covers elastic, anelastic, and viscous deformation. Although emphasis is placed on the fundamental underlying theory, advanced discussions on current debates are also included to bring readers to the cutting edge of science in this interdisciplinary area.

*Deformation of Earth Materials* is a textbook for graduate courses on the rheology and dynamics of the solid Earth, and will also provide a much-needed reference for geoscientists in many fields, including geology, geophysics, geochemistry, materials science, mineralogy, and ceramics. It includes review questions with solutions, which allow readers to monitor their understanding of the material presented.

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Deformation of Earth Materials

An Introduction to the Rheology of Solid Earth

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