

High Pressure – A New Dimension in Physics, Chemistry, Earth and Materials Sciences

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Pressure dramatically alters all substances. At each pressure interval, a new set of materials and properties emerges. Since the turn of the millennium, we have finally garnered the full capability of harnessing the pressure dimension of physics, chemistry, Earth and materials sciences.

Pressure is a powerful tool for tuning and controlling physical properties and testing fundamental theories. Investigations of novel phenomena and materials often lead to new law of physics. Pressure directly affects chemical bonding. A new Periodic Table appears at each pressure interval with the same old elements but drastically different chemistry. In nature, high pressures are generated inside the Earth and celestial bodies; high-pressure studies are therefore the key to understand their interior processes, dynamics and formation. Exotic phases discovered under pressure may often be quenched and recovered with superior performance for ambient pressure applications. Alternatively, novel theories discovered under pressure may lead to designing highly valuable materials for solving energy and environmental problems.

High-pressure science is still at its reconnaissance stage: extreme pressures have been reached only during the past three decades, and a battery of in-situ probes have become available only in this century. We are now facing a brave new world. In this vast unexplored, fertile ground, all countries are at the equal footing in competing for international leadership. Many branches of physical sciences can thus be uplifted to the next level through the passage of high-pressure research.