The impact of hyperbonding on the static and dynamic properties of chalcogenides

Tae Hoon Lee

School of Materials Science Engineering, Kyungpook National University

Email: thl@knu.ac.kr

The application area of amorphous and crystalline chalcogenide materials is very broad. Phase-change (PC) tellurides - a prototypical chalcogenide - are considered an important class of chalcogenide materials due to their unique properties inexplicable within conventional chemical bonding theories. In an effort to understand the PC materials, the nature of chemical bonding has been intensively investigated recently. The hyperbonding concept provides a theoretical framework, from which the structure and properties of PC chalcogenides can be comprehensively understood. The significance of this theory relies on its capability of establishing the structure-property relationships found in this type of materials. In this talk, we extend the applicability of this theory to other amorphous chalcogenide materials, including pure chalcogens, binary, and ternary, alloys. The new concept of hypervalency, proposed based on multi-center hyperbonding theory, enables systematic classification of short-range structural order (or structural building motifs) and offers a theoretical basis for elucidating the static and dynamic properties of many chalcogenide materials.