

MERIT Corporate Internship Report
(March 14–May 13, 2016, Sumitomo Electric Industries, Ltd.)

Department of Physics, Graduate School of Science
2nd generation student of MERIT course
Nobuya Sato

Abstract

I worked at Advanced Materials R&D Laboratories of Sumitomo Electric Industries, Ltd. at Itami-shi, Hyogo, Japan from March 14 to May 13, 2016. High functional materials are developed in the laboratory, which have high hardness, corrosion resistance, heat resistance and so on. This internship was performed toward “estimating properties of inorganic materials from first-principles calculations.”

Activities

An aim of this internship is to clarify key factors of mechanical properties in hard materials used as cutting tools. One of approaches to develop superior hard materials is to clarify the reason why existing hard materials are superior to others in such as hardness and strength. Though the bulk modulus and the shear modulus relate to mechanical properties, the correlation between hardness and these quantities is not simple. To analyze in detail, I performed first-principles calculations and investigated relationships between electronic states and hardness, strength and so on.

I pick quantities assumed to relate to mechanical properties from previous researches. Calculations of them are performed for some hard materials with most stable structures and distorted structures, and a quantity which is expected to be related to a mechanical property is found.

Summary

Since the aim of this internship is very challenging, I could not reach a final conclusion. However, I think I could find new views for further progress. Thanks to experience of researching at a corporation through this internship,

I learn difference from academic researches. Though I have attended to abstract things such as physical laws and interpretations, I realized the importance of a concrete view that what materials and properties are needed. Through the internship, I can recognize that there is a gap between physics and products and that standing the both sides is needed to close the gap. It is very fruitful experience that I know what I do not realize at the university.

Acknowledgement

I would like to thank Sumitomo Electric Industries, Ltd. including Director Minato and Chief Oohara of Advanced Materials R&D Laboratories for ready acceptance of the long-term internship. I would also like to express my gratitude to Dr. Michiuchi for discussions and supports. I owe a debt to Prof. Tsuneyuki for permitting to leave the laboratory for a long time. Finally, I would like to thank the MERIT Program for giving the precious opportunity.