

Cooperative PhD Research Project with Prof. Jiangs Group in China

Suggested Title

Thermal and Structure Properties of Near Critical Diameter of Nanocrystals Materials

Objective

The 1st time in 1975 the melting point of gold nanoparticles found to reduce its melting point according to the particle size and it reaches to 0 K when the particle radius reaches 3h where h is solid surface layer. For example the gold particle will have a liquid form at 0 K when its radius reaches about 2 nm.

Materials in the nanoscale range are active in regards of energy interaction, such as oxidation, dissolving, absorbing. That is why nanomaterials are active in Biology, Chemistry, Medicine, Pollution, Agriculture, Mechanical Engineering, Physics and many other technological points of view.

In the last ten years of the last century, attention where made to prepare and understand the material form when its size reaches downward to several nanometers. There have been many researchers who succeed in preparation and understand how physical and mechanical properties of these materials will depend on the materials size. In the beginning of this century, a great attention is made on the research on investigation of the properties and application of nanoscale size materials. As we know, we always have two ways of investigation, the first is materials preparation and the second is theoretical work. The first mostly is a costly research work and needs a high technical background and a good budget which mostly is difficult to obtain in our countries. The second way of research is more possible and easier to achieve, nowadays in particular because of the availability of good computers in the open market and mostly the availability of good access to international journals with a mostly a suitable available budget.

Overview

Thermal properties for nanoscale materials are one of the most interest subjects regard of; first the formation and second lack of information in many areas in this field such as crystalline shape and its continuity with that of the nanometric scale size. Depending on my last eight years of experience on crystallography and thermal properties on Si nanocrystals which leads to preparation of three MSc thesis and one PhD as well as another MSc work in the final stage of work with that of the long experience of Professor Jiang from Department of Materials Science and Engineering, Jilin University, Changchun, China, who published more than 50 (?) scientific article in the most famous international journals, we decided to suggest a PhD project title as **(Thermal and structure properties of near critical diameter of nanocrystals materials)**

Under this title, the researcher should study materials crystal structure in general and then simulate the obtained information to that of nanoscale range for further investigation. The second part of his work the researcher should investigate the principals of thermal properties such as the vibration effects on bonding, melting temperature, dislocations, surface bending, impurities and thermal conductivities. Principals of understanding theses subjects will be the student duty in the 1st year of his registration by obtaining specialized and general lectures as well as a report preparation. The results are to be satisfied by both internal and external supervisors. If the student passed the acquired standard, then, he will be qualified to transfer his

work to Jiang's group in china. With Jiang's group he will begin to investigate and analyze throughout theoretical calculations leading to finalize how thermal and structure properties in nanoscale materials can be reconstructed in the scale range of several nanometers of diameter.

The two subjects of the research mentioned above will give a wide range of needed information for the purpose of new technology in thin layer microelectronics as a first principal solid state application as well as all the subjects mentioned in the top of this proposal.

Research Duration Time

After the 1st year where the student spends its time in the 1st group in the University of Salahaddin, he needs a minimum one year to spend with the second group (Jiangs group in China) where it may be extended up to two years. The student will spend his last year as a final steep with the internal supervisor in the University of Salahaddin to finalize his research work and writing his PhD thesis.

Regulations;

For external supervisor, please indicate

1- University fees, -----[pear year---- if any (In US \$))

2- Externals supervisors fees (pear year)

Needed information

Please give information about the expected students live cost pear year (pear person) Indicating accommodation, transport, medical needs, extra(in one year time from now)

External supervisor

Prof. Q. Jiang

Department of Materials Science and Engineering, Jilin University, Changchun, China

Internal Supervisor

Dr M S Omar

Department of Physics, College of Science
University of Salahaddin, Arbil, Iraqi Kurdistan,
Iraq