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Editorial Open Access

# The Applications of Atomic Force Microscopy in Materials Science Research

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## Editorial

Currently, atomic force microscopy (AFM) is widely used by many researchers from around the world in materials science applications. Why? Before answering the question, let us look at the history of atomic force microscopy quickly. The precursor to the AFM was developed by Gerd Binnig and Heinrich Rohrer in the early 1980 at IBM Research-Zurich. However, Binnig was invented the AFM and the first experimental implementation was made by Binnig, Quate and Gerber in 1986. Nowadays, we can observe that the number of publications making use of atomic force microscopy in order to study the topography of materials has increased from time to time. There are several advantages of using the atomic force microscopy in terms of research activities such as to investigate the film thickness, to obtain surface roughness, to imaging surfaces with nanometer resolution, to measure the size of the particles, to observe grain size distribution and to view the two-dimensional & three-dimensional images.

Here are some examples where researchers use atomic force microscopy to characterize their samples. For the first case, Anuar and co-authors have applied AFM to investigate the topography of various thin films such as SnS [1], ZnS [2], CuS [3], PbSe [4], FeS [5], MnS [6], SnSe [7], $Ni_3Pb_2S_2$ [8] and $Cu_4SnS_4$ [9]. In their research activities, the influence of different deposition parameters on the topography of thin films was successfully studied by using AFM. These deposition parameters include deposition time, bath temperature, pH, the presence of complexing agent and the different concentrations of solutions. Meanwhile, for the second case, Yu et al. [10] presented the results of AFM observations of multiwalled carbon nanotubes which clearly showed that radial deformation and collapse could be induced, and stabilized, by substrate-nanotube interactions. These carbon nanotubes had diameters ranging from 2-50 nm. Next, for the third case, analysis of the microstructure of superconducting $YBa_2Cu_3O_y$ (YBCO) foams by means of AFM by Koblischka et al. [11]. YBCO foam samples show an open, porous foam structure which may have benefits for many applications of high-Tc superconductors. Lastly, for the fourth case, AFM is utilized to study the changes in morphology and particle size of $LiFePO_4$ cathode during discharge by Demirocal et al. [12]. The reliable AFM measurements based on different designs are presented by them in order to provide Li-ion batteries for future plug-in hybrid electric vehicles.

I believe that, AFM can become a powerful tool in future in materials science research. Because of materials science deals with the discovery and design of new materials. In addition, characterization of materials in this field has received much attention from scientists recently.

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