4 - 24 Main Work Outline of the Irradiation Technique Group in 2016

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The main work of the irradiation technique group focuses on the following two aspects in 2016:

1. Technique support

We have had about 772.5 h beam time for 39 rounds of single event effect(SEE) tests, which is cooperating with various institutes, universities, and companies. The tests are the basic safeguard for the spacecraft and satellite. In order to guarantee the test efficiency of the Terminal 5, the maintenance and improvement for the vacuum, the sample transfer and beam monitor system have been achieved.

2. Research work

1) Investigation of properties of Cu/Ni multilayer nanowires

The coercivity Cu/Ni multilayer nanowire array was investigated with different diameters, periodicity and layer thicknesses. The increasing in coercivity with increasing Ni layer thickness and is due to the enhanced shape anisotropy of single Ni layer and dipole-dipole coupling effect between neighboring Ni layers. And the results was theoretically calculated and analyzed by the Pant's model.

2) Irradiation effects of gold nanowire

The irradiation effects on single crystalline gold nanowires has been studied. The gold nanowires(NWs) on the Au/Cu substrate were characterized by SEM after dissolving the polycarbonate template. The crystal structure of the prepared nanowires and the size dependence of irradiation damage induced by the heavy ions were investigated by HRTEM.

3) The rectification effect of single graphene/PET nanopore

The single graphene/PET nanopore was successfully prepared by using ion irradiation technology and asymmetric etching method and the corresponding ionic transport properties were investigated in detail. The large rectification ratio up to 190 was obtained in G/PET nanopore in the acidic conditions.

4) The damage Effect of Single-layer MoS_2

The number of layers of MoS_2 prepared by CVD (chemical vapor deposition) method was determined by optical microscopy and Raman spectroscopy. The damage effects of monolayer MoS_2 under high energy ^{209}Bi ion irradiation was analyzed by Raman analysis and AFM observation. And the results are compared and analyzed before and after the beam irradiation of single layer MoS_2 prepared by mechanical stripping method.

4 - 25 Tuning the Coercivity of Cu/Ni Multilayer Nanowire Arrays by Tailoring Multiple Parameters

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In recent years, the magnetic multilayered nanomaterials have been extensively studied for electronics[1], ultra high tensile strength[2], high storage media[3], and microwave devices[4] since the giant magnetoresistance(GMR) effect was found in 1988. As a member of 1D nanostructured materials, the ferromagnetic and nonmagnetic multilayer nanowires also exhibit tremendous potential applications in many fields due to their unique magnetic and electrical properties. In this work, the Cu/Ni multilayer nanowire arrays are prepared in ion track template with electrodeposition method and a new facile method is first introduced to easily confirm the different layer thickness and component by removing the nonmagnetic layer of Cu. Based on this method, we successfully turn the coercivity of Cu/Ni multilayer nanowire arrays by varying the multiple parameters, including Cu and Ni layer thickness and periodicity.

After growing Cu/Ni multilayer nanowires in etched ion track template, the morphology of the nanowires were first characterised by SEM. As shown in Fig. 1(a) and (b), the Cu/Ni multilayer nanowires with the diameter of 90 nm are displayed. In Fig. 1(a), it is obviously confirmed that the prepared Cu/Ni nanowires are homogenously distributed on the original gold/copper substrate and collapse together because of the high aspect ratio without the restriction of PC template[5]. As presented in Fig. 1(b), the altering dark gray and light gray contrast layers should be Cu layers (proved by the EDS analysis) and Ni layers, respectively, which confirms that the multilayer structure of Cu/Ni nanowires has been successfully prepared. And the average layer thickness of multilayer nanowires is also