Supplementary Information

Controllable synthesis of ferromagnetic-antiferromagnetic core-shell NWs with tunable magnetic properties

M. Irfan, C. J. Wang, U. Khan, W. J. Li, X. M. Zhang, W. J. Kong, P. Liu, C. H. Wan, Y. W. Liu, X. F. Han*

Beijing national laboratory for condensed matter physics, institute of physics, University of Chinese academy of sciences, Chinese academy of sciences, Beijing, 100190, China.

*Corresponding Author (xfhan@iphy.ac.cn)

Structural analysis:-

In case of Ni-nanocore Bragg's peaks reflected from (111), (200) and (220) planes are located at 2θ = 44.40°, 51.69° and 76.15°, respectively and correspond to cubic crystal structure, designating with the filled circles in Fig. S2. Moreover, Bragg's peaks reflected from (110), (200) and (211) planes are located at 2θ = 44.60°, 65.03° and 82.26°, respectively and correspond to cubic crystal structure for the case of Fe nanocore and designated with the filled tilted squares at an angle of 45º. The structural behavior of NWs embedded in NSs is similar with JCPDS (PDF#65-0380 and PDF#65-4899) respectively.

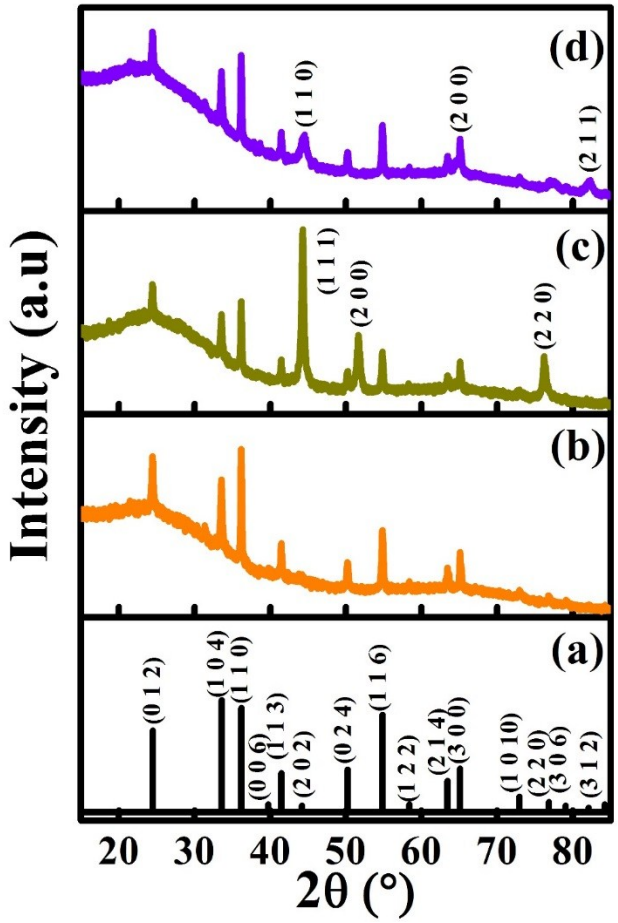

Fig. S1 XRD-patterns of core-shell NWs geometry, (a) Indexing of reflections using (PDF#38-1479) diffraction card, (b) Structural analysis of Cr_2O_3 NSs within the template, (c) XRD pattern for Ni/Cr_2O_3 core-shell NWs and (d) XRD pattern for Fe/Cr_2O_3 core-shell NWs.

Role of Etching solution in present study:-

Usually NaOH etching solution is being use widely to remove the AAO-template partially or complete, however when we tried to use NaOH solution for Cr_2O_3 NSs, we observed that this solution also etched our Cr_2O_3 NTs. So, we need to change the etching agent which remove AAO-template but not the Cr_2O_3 NSs geometry. Fig. S1 displays the morphology for the case of NaOH

Solution. Then we used new etching solution containing 4.5g CrO_3 and 3.1 ml H_3PO_4 in 100ml of deionized water and achieved crack-free, highly uniform and good morphology for Cr_2O_3 NSs as shown and discussed in details in the main manuscript.

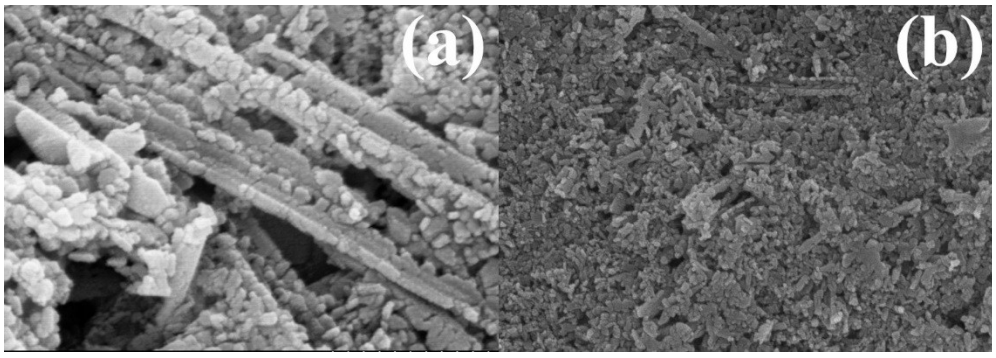

Fig. S2 SEM images Cr_2O_3 NSs etched using NaOH