Here we present the study of semiconductor properties of bismuth nanoparticles assembled on bundles. Priority was set on the reaction parameter pH (7, 4, 2) to obtain narrow distribution size nanoparticles, to studying their optical absorption properties by electron energy loss spectroscopy (EELS). As reported by literature, semimetal to semiconductor transition takes place when particle size decrease to a smaller size than that of the exciton radius. Analysis on individual bismuth nanoparticle was possible by EELS spectroscopy, in which the plasmon region is easily accessible. It was found, nanoparticles with diameter as small as 5.2±1.53 nm assemble in bundles at pH 4, remain stable and avoided coalesces under electrons irradiation while EELS analysis was performed at 80 kV. Under such conditions, it was possible to confirm the semiconductor properties of individual bismuth nanoparticle as the volume plasmon blue-shifts to a higher energy (29.1 eV), which is related to widening of the band gap due to size effects in semi-metallic bismuth nanostructures.

**Keywords:** BISMUTH, PLASMON, EELS

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