

STUDY OF THE HUMAN DENTAL ENAMEL BY HIGH RESOLUTION MICROSCOPY. Georgina Carbajal de la Torre⁽¹⁾, I. Gil-Chavarría⁽¹⁾, R. García-García⁽¹⁾, J. Reyes-Gasga⁽¹⁾. 1. Laboratorio de Física de Nuevos Materiales, Depto. De Materia Condensada, Instituto de Física, UNAM. Apartado Postal 20-364, 01000 México, D.F., México.
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The hidroxyapatite (HAp) $\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$, is the model structure for the apatites forming the inorganic components (96%) of bones and teeth. To achieve a better understanding of the processes of biomineralization and to enable design of artificial biomaterials a thorough understanding of the structure and of chemistry of the HAp and other calcium orthophosphates is fundamental^[1]. In the dental enamel their structural unit is formed by many prisms in the size range of tenths of microns, which run from the enamel-dentin junction to the enamel surface. These prisms are formed by many elongated crystals inside an organic matrix. These crystals have a diameter from 50 to 100 nm in transversal section, and from 300 to 500 nm in longitudinal section, approximately. When the enamel crystals are observed with the microscope, they exhibit a central dark line^[2] that crosses the long of the hidroxyapatite grains and that it has not been characterized structurally until the moment, and it is known that it is a vulnerable place in the crystals of the enamel even ending up thinking that it is susceptible to the cavity attack^[3], but using the microscopy of high resolution Takaaki^[4] has found that the central dark line resists the dental breakup. The hidroxyapatite powder was obtained of human dental enamel from several noncarious human teeth of a 15 and 30 years old patient. For their observation in the microscope, all the powder enamel was separated from the dental piece and treating these after at 80 °C to eliminate the remainder organic material, after this it was washed with distilled water and ethanol, then the sample was milled and cleaned and filtered through a 325 mesh grid, obtaining a fine powder that is deposited in copper grids previously covered with colodion film and carbon. Afterwards these Cu grids, already with the enamel powder were recovered again with a carbon film of 20 nm thick to minimize electron beam damage and electrical charge effects produced during the observation of the enamel grains. The deposited materials on the grids were observed by an electronic microscope JEOL FEG 2010 operated at 200 kV and by the Z-contrast (HAADF). The crystals where sufficiently thin and transparent for an electron beam. The specimens of dried enamel powder consisted of agglomerates of thin platelike crystals. During the crystals observation, a dark line of 1 to 1.5 nm wide crossing the crystal center. This line has been denominated "central dark line (CDL)", although certainly its contrast depends on the focus: it appears dark in underfocus, dissapears when the image goes through focus, and is white in overfocus^[5]. In figure 1A an image of HREM of the crystals of enamel is shown with the central dark line in its center with its image of corresponding Fourier transform obtained from the software Digital Gatan Micrograph and in Z contrast the dark line is white, this is for the technique, (figure 1B). To get information about the chemical composition, electron energy loss spectroscopy (EELS) were obtained from the enamel crystals. The images of EELS and Z-contrast indicated a great concentration of Ca around the CDL region than in the rest of the enamel crystal.

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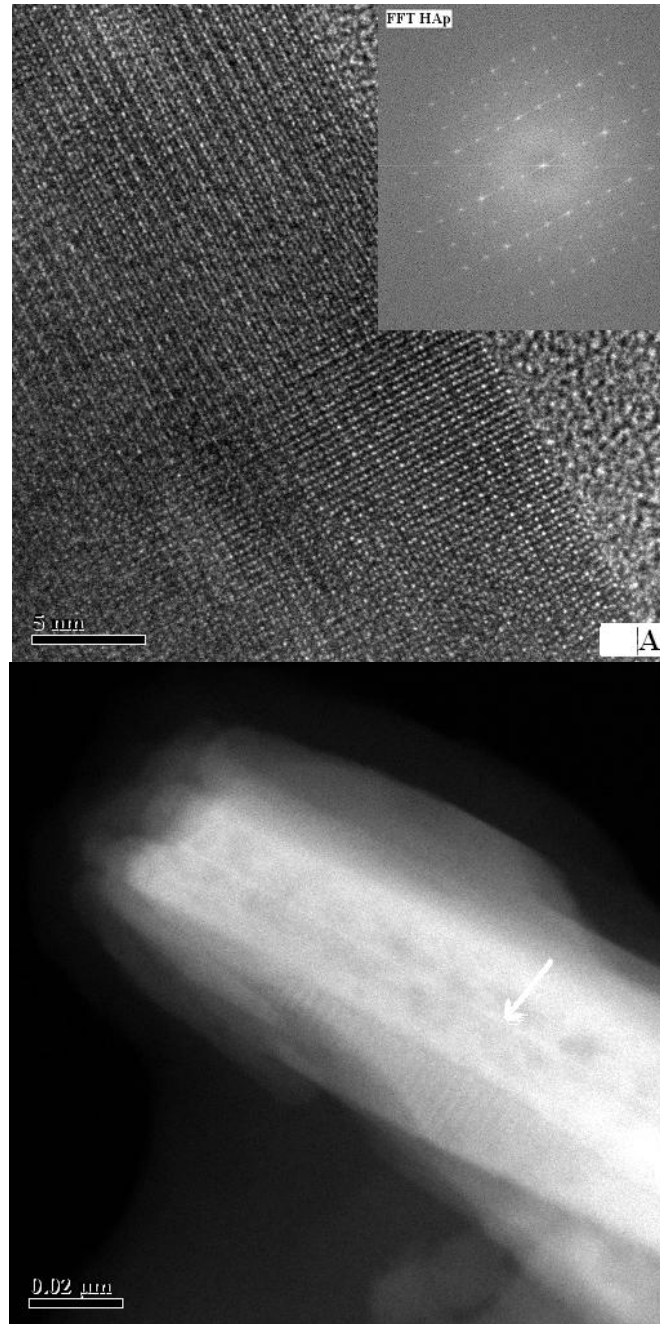


Figure 1A) HREM image with the corresponding Fourier transform inset, **1B)** Z- contrast image with the CDL white.