

m19.p03

Transition of laser-treated dental enamel

Ulli Bismayer^a, Boriana Mihailova, Shengqiang Zhang, Arndt Klocke^b, Biliana Gasharova^c

^aDepartment of Earth Sciences, University of Hamburg. ^bUKE, Univ. Hamburg, ^cForschungszentrum Karlsruhe, ISS/ANKA, Germany. E-mail: mi4a001@uni-hamburg.de

Keywords: apatite, IR and Raman spectroscopy, dental materials

The application of lasers in clinical dental practice is becoming increasingly popular, because of the painless, time-saving, and easy-handling treatment of teeth. However, it is still not clear what really happens with the atomic structure of hydroxyapatite under laser irradiation. To study this issue, different spatial areas of laser-treated human enamel and synthetic hydroxyapatite were investigated by Raman and attenuated total reflectance infrared micro-spectroscopy. The laser-treatment parameters were close to those used in clinical practice. The spectra were collected from spatial areas showing different laser-induced morphological alteration. Inside the laser crater anhydrous calcium phosphate phases are formed, as the degree of structural transformation depends on the applied laser power. In the periphery of the laser spot an exchange of CO_3^{2-} to CO_2 occurs. When higher laser power is applied, an exchange of molecular groups embedded in hydroxyapatite was detected. In addition, the enhancement of the IR absorption typical for grain-surface OH groups suggests a decrease in the long-range order of apatite crystallites in the periphery of the laser spot. Comparison of spectroscopic data on laser- and thermally-treated enamel reveals that inside and in the vicinity of the laser impact region the temperature can reach 1100 K and 700K, respectively. The utilization of super-pulse rather than continuous-wave irradiation mode results in a higher degree of structural alteration and inhomogeneity.

m19.p04

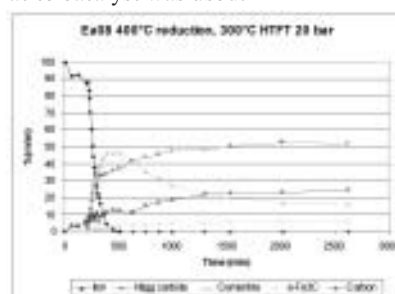
Iron carbide phase transitions during high temperature Fischer-Tropsch

H.E. du Plessis¹, J.P.R. de Villiers², G.J. Kruger¹, J.J. Retief³

¹University of Johannesburg, P.O. Box 524, Auckland Park, South Africa, ²University of Pretoria, Pretoria, South Africa., ³Sasol Technology R&D, Sasolburg, South Africa

Keywords: iron carbides, HTFT, phase transitions

Iron carbides are amongst some of the phases formed during Fischer Tropsch synthesis using iron catalysts. The specific carbide phase present during catalysis can be related to the formation of certain hydrocarbons from synthesis gas. A number of iron carbide phases have been identified and their structures have been determined [1,2]. New instrumentation and techniques are available to study crystalline structures, especially modern powder X-ray diffractometers and software. A series of High Temperature Fischer Tropsch (HTFT) reactor runs was done using the Anton Paar reaction chamber on the X'Pert Plus MPD diffractometer. This was done to simulate the formation of various iron carbides in a commercial reactor. HTFT conditions were used since very little wax was formed and resulted in better interpretation of powder data. Spray-dried unpromoted hematite catalyst was used.



Cementite and Hägg carbide were formed when reduced iron was exposed to syngas in the reactor. Cementite converted to Hägg carbide with time on stream (TOS). The crystalline carbon content increased with TOS.

[1] Nakagura S. (1959) *J Phys Soc Jpn*, 14, 186

[2] Dirand M. and Afqir L. (1983) *Acta Metall.*, 31, 1089