

## Structural Characteristics of Some Cobalt Dental Alloys After Heat Treatments

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**Introduction :** Cobalt based superalloys continuous to be used with great interest in dentistry due to simultaneously properties, such as: high mechanical characteristics (yielding strength, ultimate strength, hardness), biocompatibility, or wear resistance [1,2,3,4,5]. In dentistry cobalt is still used for realizing of partial or total prosthesis. The problems which are met during casting of prosthesis are connected to cracks susceptibility and brittle behaviour after a rather short time of prosthesis working. Present paper is focused on structural modification analysis on different cobalt alloys used for denture prosthesis.

**Methods:** In present paper there are presented results of investigations on samples of partial removable denture made of cobalt base alloys (Co-Cr-Mo) regarding specific structural analysis: structural phases (by X-Rays diffraction was made on DRON 3 device), qualitative and qualitative microstructural analysis (on REICHERT microscope equipped with IMAGE –Pro software for analysis), microhardness determinations versus different casting parameters [1,2,3,4].

**3. Results:** Chemical composition of the experimental alloy is in accordance with ISO 5832 /4/, respectively: 0,29%C, 26,5%Cr, 5,35%Mo; 0,60%Ni; 0,64%Fe and Co rest. X-Rays diffraction (**figure 1**) put in evidence the specific phases in a cobalt alloy.

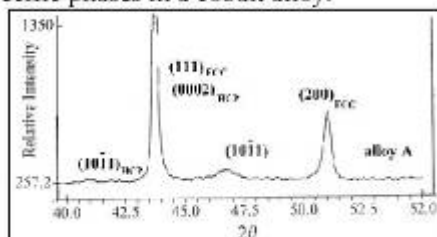
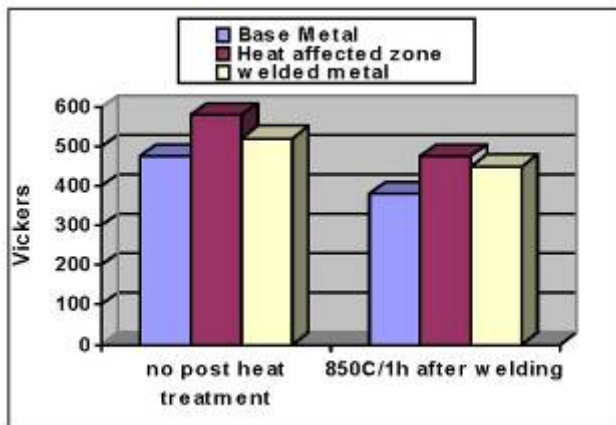


Fig. 1-X-Rays Diffractions of HERAENIUM CE experimental cobalt alloy



The microstructure results of the as cast alloys are shown in **Figures 2 (a)**, consisted of cobalt-rich FCC matrix dendrites, very fine interdendritic eutectic, but high grain sizes. After applying a heat treatment at 850°C/ 1 h/ air the carbides may refine, and the grains are equiaxed. Microhardness measurements (**figure 3**) reveal the increase both of grains sizes and the particles size in the welded metal and in the heat affected zone.

**DISCUSSION & CONCLUSIONS:** Optical microscopy observations indicated that of *HERAENIUM CE experimental cobalt alloy* exhibited interdendritic carbides, solute segregation, relatively large grains; The tensile properties of the heat-treated alloys exhibited significant improvements in ductility and strength when compared with the as-cast counterparts. The main effect of alloy preheating was manifested as a removal of the extensive interdendritic carbide precipitation and appreciable break-up of the dendritic grain structure. This leads to the development of a homogenous equiaxial grained structure and the consequent improvement in mechanical behaviour (by microhardness measurements); By welding with different laser technology, the materials for dental applications may be repair. Cracks may appear either due to casting technology, or to welding by laser.

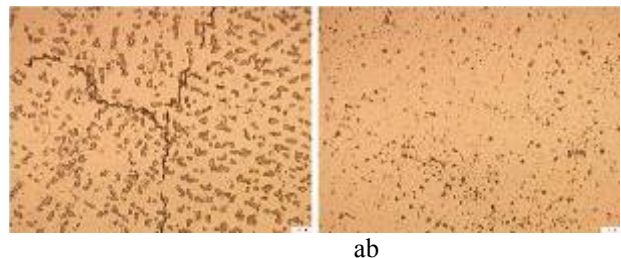


Fig. 2. Microstructural aspects of HERAENIUM CE experimental cobalt alloy

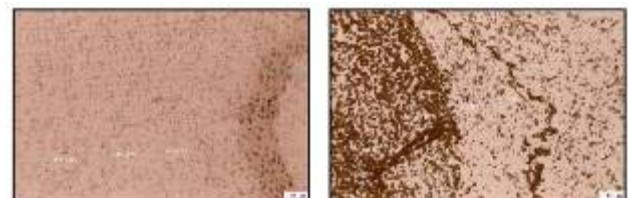


Fig. 3-Microhardness Vickers values of HERAENIUM CE experimental cobalt alloy samples: (a) with no post heat treatments, (b) 850°C/1h/air after heat treatment

**REFERENCES:** C. BorȚun, I. Mitelea, L. Miloș, V. Bîrdeanu, L. Sandu (2005) *Analysis of laser welded joints on „C” alloy used in removable partial dentures technology*, European Cells and Materials vol.10, Suppl. 1 pg 31, L. Sandu, C. BorȚun, L. Ardelean, N. Faur (2005) *Finite element analysis of stress distribution induced by thermal variations on cast clasps*, European Cells and Materials, vol.9, Suppl.1 pg 3-4.