

LASER SINTERING TECHNOLOGY USED FOR CO-CR DENTAL RESTORATION

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INTRODUCTION: Selective laser sintering (SLS) is a technology that uses a high power CO₂ laser to fuse small particles of metal powders (Direct Metal Laser Sintering) into a mass representing a desired 3-dimensional object.

The laser selectively fuses metal powders by scanning cross-sections generated from a 3-D digital description by CAD file or scan data on the surface of a powder bed. After each cross-section is scanned, the powder bed is lowered by one layer thickness, a new layer of material is applied on top, and the process is repeated until the part is completed.

METHODS:

The topography of the dental restoration is designed by numerical monitoring after having scanned devised prostheses (Fig.1)

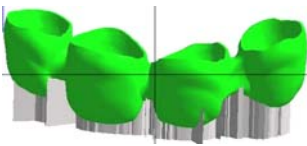


Fig. 1 Fig.1 Scan data from virtual image



Fig. 2 Fig. 2 The laser selectively fuses metal powders from a scan dat

The laser is thus programmed in such a way that it only becomes active at the site where the element should be achieved. The alloy particles will be sintered by the laser energy. In our application the alloy consists of 64-67 Co, 28-30 Cr and 5-6 % M, and has at equilibrium of a γ monophasic structure

Fig.3 Final objects Prosthetics restoration



RESULTS & DISCUSSION

- Dimensional observations of Co-Cr restorations show that adjustment leads to satisfactory clinical results with a precision of 25 μ m.
- The average hardness is 395HV, comparable to metallo-ceramic elements obtained by casting technique.

- The metallographic observations show a slight porosity in the horizontal plan (sintering plane) Fig. 4.

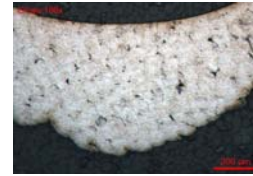


Fig. 4 Porosity in the structure of layers CoCr

- Punctual analysis shows a high regularity of the local chemical composition 62.6-64.1% Co, 29.3-30.5% Cr, and 4.9-6.4 % Mo
- Potentiodynamic polarization curves confirm the presence of the porosity in the structure of the restoration (Fig. 5)

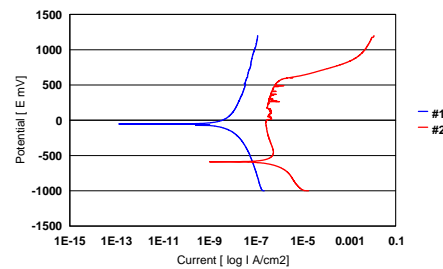


Fig.5 Polarisation curves in Fusayama saliva

The curve #1 is drawn after 4 h of immersion and the curve #2 after 72 hours.

CONCLUSIONS:

The technique of manufacturing by selective laser sintering allows to obtain elements prosthetics at high dimensional precision, and presenting mechanical properties in agreement with the clinical requirements.

However, the residual porosity inherent to the sintering process may present a risk for fracture and crevice corrosion.