Characterization of diamond coated Ti dental bits

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1. Introduction

- Bio-applications of diamond: Excellent properties of diamond affixed to bone, as well as its intrinsic properties
- Durability and osteo-integration of implant predicted to be enhanced with coating of diamond thin films
- Presented here are preliminary results of deposition of diamond films on Ti dental implants, along with their SEM images, XRD and Raman analysis

2. Experimental

- Pre-treatment of substrate in diamond slurry (grit size 1-3µm, in methanol)
- 4 hour deposition using TMCVD consisting of 4 cycles; 6 sccm CH_4 (3% CH_4/H_4) for 10 mins., followed by 3 sccm CH_4 (1.5% CH_4/H_2) for 50 mins.

Parameter	Value
Flow of H_2	200 sccm
Temp. of filaments	2100 ± 100˚C
Temp. of substrate	700 ± 100˚C
Deposition pressure	30 torr

Fig. 1 Experimental parameters

3. Results

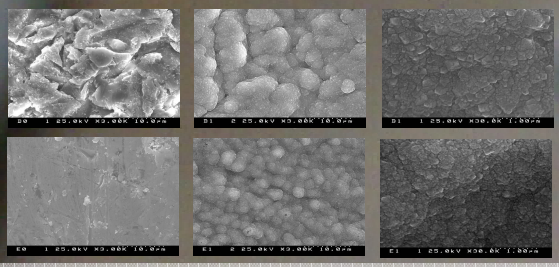

Fig. 2 SEM images: Clockwise from top; Ti substrate with Emfil PT at 3k magnification (D0), D0 with diamond growth at 3k, 30k magnifications, Ti substrate (E0) with diamond growth at 30k, 3k magnifications, E0 at 3k magnification

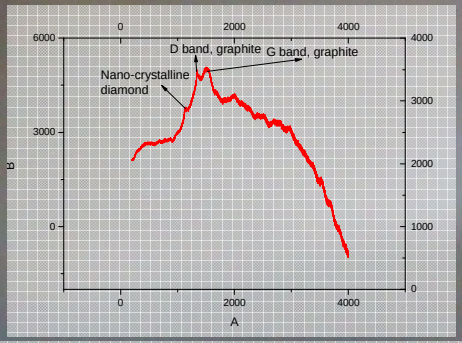

Fig. 3 Raman analysis: Ti implant with Emfil treatment, which has undergone deposition

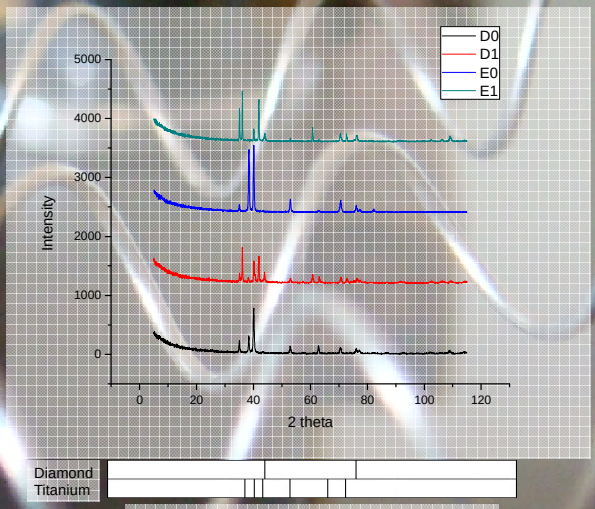

Fig.4 XRD pattern of samples, showing diamond peaks

4. Discussion

- From the SEM images, we see that there is not much morphological difference between substrates with and without Emfil treatment. However, the presence of diamond is clear from the images
- Raman analysis shows the presence of peaks corresponding to nano-crystalline diamond, D and G bands of graphite
- Presence of diamond is further evident in the XRD analysis of the samples

5. Conclusions

- From preliminary study, we can conclude that it is possible to deposit diamond films on dental implants, despite its complex geometry
- However, before large scale deposition of diamond can be carried out on dental implants, deposition procedure must be optimized and the repeatability of the process must be verified

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