Improvement of surface properties of Nitinol alloy through deposition of graphene by Electrophoretic deposition technique for biomedical applications.

ABSTRACT

The superelastic nature of biocompatible material nitinol & its alloys is utilized for the application of orthodontic archwires due to its ability to prevent strain localization & plastic deformation. However, they tend to wear over time due to continual contact with body fluids and release toxic metal ions (Ni^{2+}) into the body. In order to overcome this limitation smooth layers of graphene was deposited on Nitinol wires by Electrophoretic Deposition technique to improve its wear resistance and other mechanical properties.

The electrodeposited coatings were characterized by Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), X-Ray diffraction, Raman spectroscopy and Potentiodynamic polarization technique. Raman spectroscopy showed the presence of graphene & 2-D graphitic phase. Finally, a post deposition treatment was done to evaluate in-vitro bioactivity by Simulated Body Fluid (SBF) immersion test. The results showed that graphene coating onto Nitinol substrate improved anti-corrosion rate and anti-bacterial properties while reducing friction as compared to bare Nitinol wires.

Hence, this bioactive coating exhibited better mechanical strength, enhanced wear and corrosion resistance indicating high potential for biomedical applications.

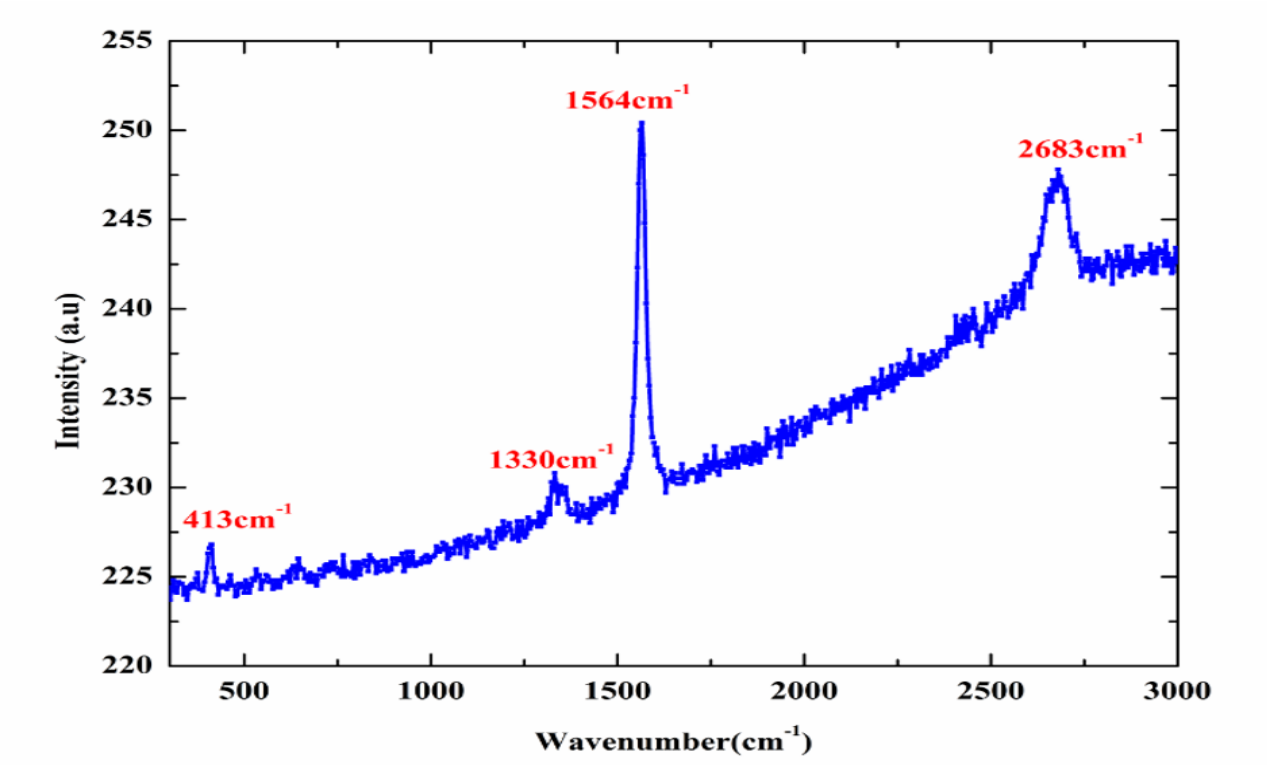

Fig 1. Raman Spectroscopy of sample

Fig1. shows Raman spectra of the sample which indicates 2D band at around 2683 cm^{-1} for multi-layer graphene, G peak at around 1564 cm^{-1} for 2-D graphitic phase and D band (presence of defects) at around 1330 cm^{-1} respectively.