Mo-P15

PULSED LASER DEPOSITION OF BIOACTIVE GLASS FILMS IN AMMONIA AND DISILANE ATMOSPHERES

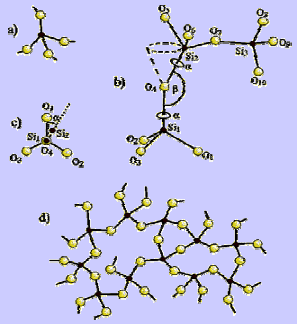
J. P. Borrajo, P. González, S. Liste, J. Serra, S. Chiussi, B. León, M. Pérez-Amor

University of Vigo, Department of Applied Physics, Lagoas-Marcosende, 36200 Vigo, Spain; e-mail: jpb@uvigo.es

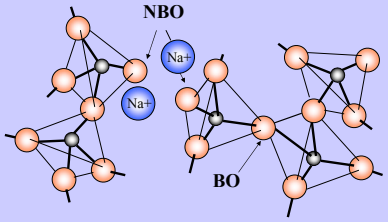
AIM

To study the influence of Si_2H_6/Ar and NH_3/Ar atmospheres, with different pressure ranges, on the properties of silica-based bioactive glass coatings produced by Pulsed Laser Deposition (PLD)

MATERIAL: BIOACTIVE GLASS

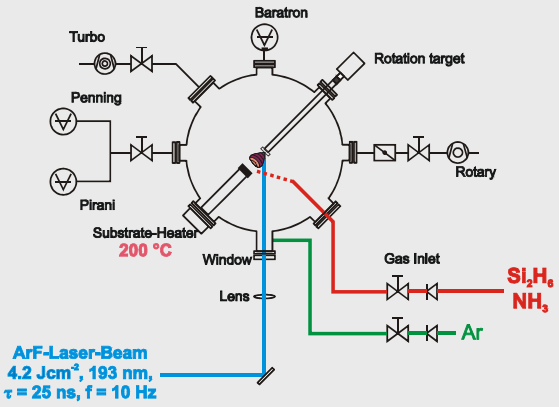


The bioactive silica-based glasses present an open amorphous network which structural unit consists on slightly distorted SiO_4 tetrahedra.



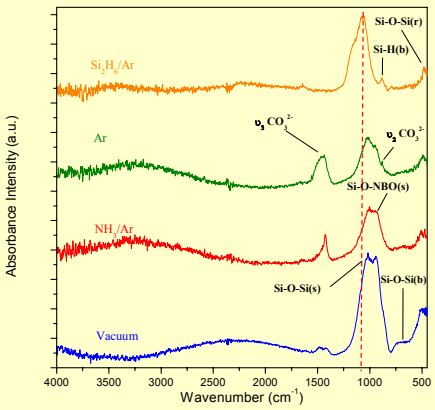
- Accommodation of network modifiers (alkali and alkali-earth cations) provokes disruption of the glassy network.
- Bridging oxygen (BO): oxygen atoms covalently bonded to a silicon neighbour.
- Non-bridging oxygen (NBO): oxygen being linked to a modifier cation.
- The arrangement and total amounts of NBO and BO groups determines bioactive performance.

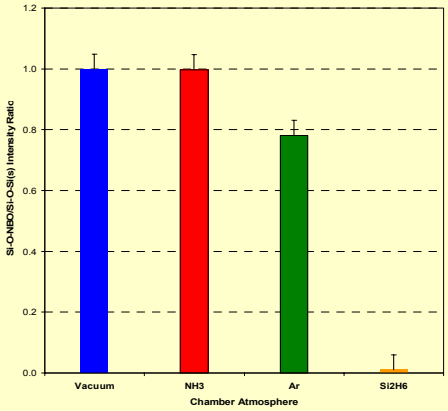
METHOD: Reactive PLD



RESULTS

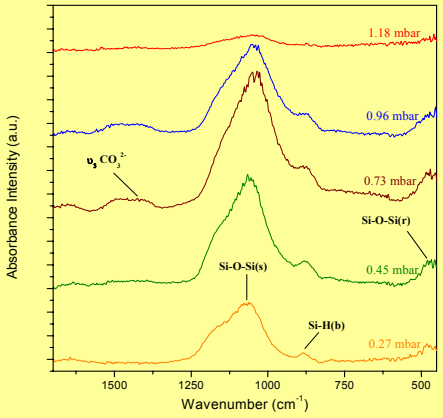
Influence of the Atmosphere Type





- Typical absorption bands for bioactive glasses have been identified:
  - Si-O-Si(s) stretching mode in the range 1000-1200 cm^{-1}.
  - Si-O-NBO between 890-950 cm^{-1}.
  - Si-O-Si(b) bending mode located around 760 cm^{-1}.
  - Si-O-Si(r) rocking mode around 500 cm^{-1}.
- For **Ar** and **NH_3/Ar** atmospheres the CO_3^{2-} band is enhanced.
- For **Si_2H_6/Ar** atmosphere a Si-H(b) absorption band emerges.
- Shift of the maximum absorbance of the Si-O-Si(s) band (-------) indicates a strained suboxide network, induced by the incorporation of network modifiers to the coating.
- NBO groups in the coating are maintained for **NH_3/Ar** ambient, reduced for **Ar** and suppressed for **Si_2H_6/Ar** atmosphere.

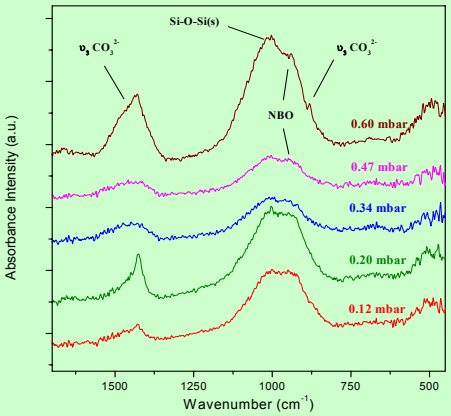
Influence of Disilane Pressure



With Si_2H_6/Ar pressure increase:

- Slight incorporation of CO_3^{2-} groups to the coating
- The deposition rate is reduced.

Influence of Ammonia Pressure



For NH_3/Ar pressure increase:

- Presence of NBO groups remain constant except for high pressures.

CONCLUSION

- The type of the reactive atmosphere in the surroundings of the plasma plume clearly affects the bonding configuration of the resulting film.
- Low pressure of ammonia/argon atmosphere is the optimum condition to obtain coatings with improved properties for bioactive applications, in terms of concentration of NBO groups.

ACKNOWLEDGEMENTS

MINISTERIO DE EDUCACION Y CIENCIA

XUNTA DE GALICIA