Electronic Supplementary Material (ESI) for Journal of Materials Chemistry


# Structure and mechanical properties of gelatin/sepiolite nanocomposite foams

**Martin Frydrych[a,b], Chaoying Wan[a], Ralph Stengler[b], Kevin U. O'Kelly[a], Biqiong Chen[a*]**

[a]*Trinity Centre for Bioengineering, Department of Mechanical and Manufacturing Engineering, College Green, Dublin 2, Ireland. E-mail: chenb@tcd.ie; Tel: +353 1 896 1729; Fax: +353 1 679 554.*

[b]*Department of Mechanical and Plastics Engineering, University of Applied Sciences Darmstadt, Haardring 100, 64295 Darmstadt, Germany.*

## Supporting information

### 1. Biomineralisation

The gelatin and gelatin/sepiolite nanocomposite (containing 9.1 wt% clay) films were sectioned into 10 x 10 $mm^2$ specimens and immersed in a 2.5 wt/v% glutaraldehyde (Sigma-Adrich) solution in a phosphate buffer (Sigma-Aldrich) at pH = 7.4 for 24 h at room temperature for crosslinking. The crosslinked films were then washed with distilled water repeatedly and air-dried at room temperature for 4 days. Biomineralisation was performed by immersing the crosslinked films into a 10 times concentrated simulated body fluid (10 SBF) at room temperature up to 21 h, during which the 10 SBF solution was changed every 2 h. The 10 SBF solution was prepared following Tas and Bhaduri's method.[1] A stock solution containing NaCl, KCl, $CaCl_2$, $MgCl_2.6H_2O$, and $NaH_2PO_4.H_2O$ with pH = 4.1 was prepared in advance, then $NaHCO_3$ was added under continuous stirring at room temperature, and the pH value increased to 6.5. Upon removal from 10 SBF solution at predetermined intervals, the specimens were gently rinsed with distilled water and air-dried at room temperature.

Scanning electron microscope (SEM) images of the neat gelatin and gelatin/sepiolite nanocomposite films after biomineralisation are shown in Fig. S1. The results indicate that calcium phosphate minerals could be induced on the gelatin surface as a consequence of the interaction between the $–COO^-$ from the gelatin and $Ca^{2+}$ ions from SBF.[2,3] Once the samples were immersed in the 10 SBF solution for 4 h, some crystal clusters were formed with cubic crystals on the neat gelatin film surface, while lots of smaller hexagonal crystals were found to cover the gelatin/sepiolite surface, as illustrated in Fig. S1 a and b. After 6 h and 21 h, both films were covered with spherical aggregates but with different morphologies, as seen in Fig. S1 a1-a2, b1-b2. In respect to the gelatin/sepiolite nanocomposite it is hypothesized that the silanol groups of clay play a major role in the apatite formation, which act as chelating agents on $Ca^{2+}$ and $PO_4^{3-}$ ions.[4,5] The comparison of all SEM images clearly demonstrates that the nanocomposite archived higher biomineralisation rates.

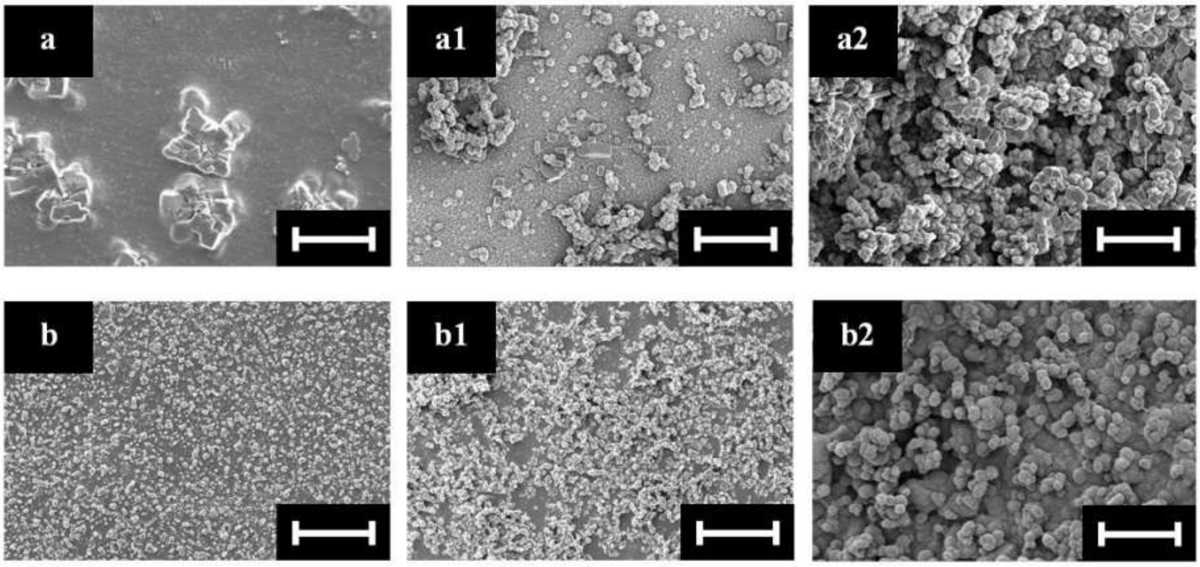


**Fig. S1**. SEM images of the surface morphology of gelatin films after a biomineralisation process in 10 SBF for (a) 4 h, (a1) 6 h and (a2) 21 h; and gelatin/sepiolite nanocomposite films with 9.1 wt% sepiolite after (b) 4 h, (b1) 6 h and (b2) 21 h (scale bar: 10µm).

## References

1 A. C. Tas and S. B. Bhaduri, *J. Mater. Res.*, 2004, **19**, 2742.

2 X. Li, J. Xie, X. Yuan, Y. Xia, *Langmuir* 2008, **24**, 14145.

3 A. C. Tas and S. B. Bhaduri, *J. Amer. Ceram. Soc.*, 2004, **87**, 2195.

4 K. Madhumathi, P. T. Sudheesh Kumar, K. C. Kavya, T. Furuike, H. Tamura, S. V. Nair and R. Jayakumar, *Int. J. Biol. Macromol.*, 2009, **45**, 289.

5 C. Wan and B. Chen, *Nanoscale*, 2011, **3**, 693.