

## Supporting information

### Surface modification and cathodic electrophoretic deposition of ceramic materials and composites using Celestine blue dye.

Y.Liu, M.S.Ata, K.Shi, G.-z.Zhu, G.A.Botton and I.Zhitomirsky\*

Department of Materials Science and Engineering

McMaster University

1280 Main Street West

Hamilton, Ontario, Canada

L8S 4L7

\*E-mail: [zhitom@mcmaster.ca](mailto:zhitom@mcmaster.ca)

Phone: 1- (905) 525 – 9140

### QCM studies

The quartz resonators were coated using 1 mL of suspension, containing 20  $\mu\text{g}$  of  $\text{MnO}_2$  and 5 % PVDF binder, dissolved in 1 mL of N-methylpyrrolidone. The suspension was cast on a resonator, which was then dried in oven.

The resonator was immersed in 70 mL of DI-water and frequency was stabilized during 15 min. Then 10 mL of 0.4  $\text{g L}^{-1}$  CB solution was added without stirring.

The mass  $\Delta m$  of adsorbed material was calculated using Sauerbrey's equation:

$$-\Delta F = \frac{2F_0^2}{A\sqrt{\rho_q\mu_q}} \times \Delta m \quad (1)$$

where  $\Delta F$  is frequency decrease of the QCM,  $F_0$  is the parent frequency of QCM (9 MHz),  $A$  is the area of gold electrode (0.2  $\text{cm}^2$ ),  $\rho_q$  is the density of the quartz and  $\mu_q$  is the shear modulus of quartz.

### Fabrication of zirconia particles

Zirconia particles were prepared by chemical precipitation from 0.1 M  $\text{ZrOCl}_2$  solutions in deionized water without CB (zirconia I) or containing 0.5  $\text{g L}^{-1}$  CB (zirconia II). The pH of the solutions was adjusted to pH = 8 using NaOH. The precipitated zirconia was filtered, washed with DI water and then dried in air for 48 h.

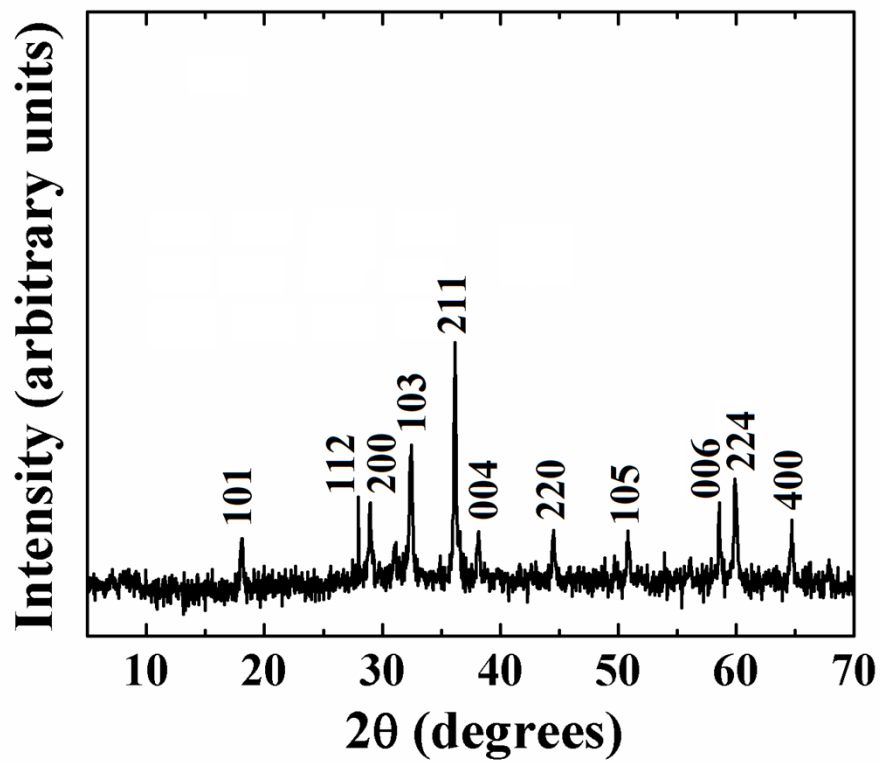


Figure S1. XRD pattern of  $\text{Mn}_3\text{O}_4$  crystals, prepared by a chemical precipitation method.

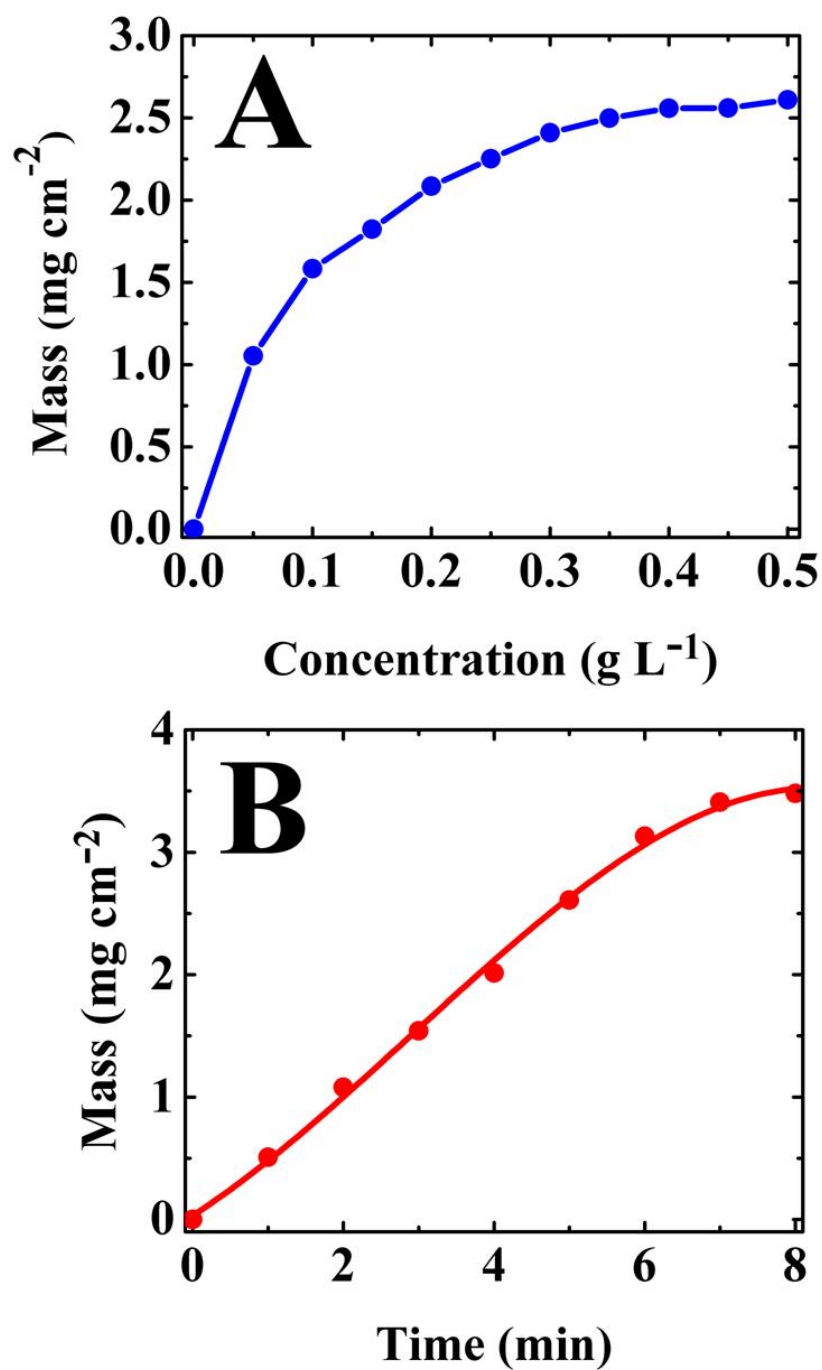


Fig.S2 Deposit mass versus (A) CB concentration at a deposition time of 5 min and (B) deposition time at CB concentration of  $0.5 \text{ g L}^{-1}$  for  $4 \text{ g L}^{-1}$  HNT suspensions.

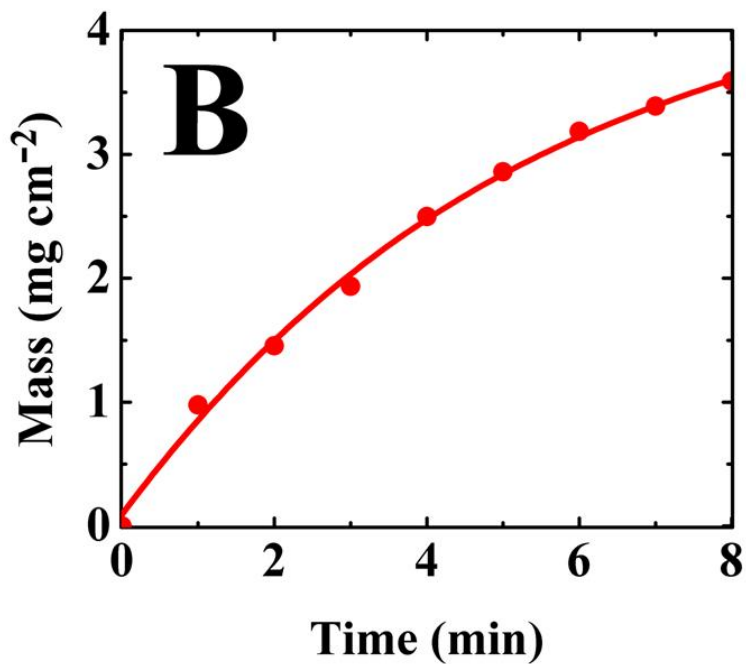
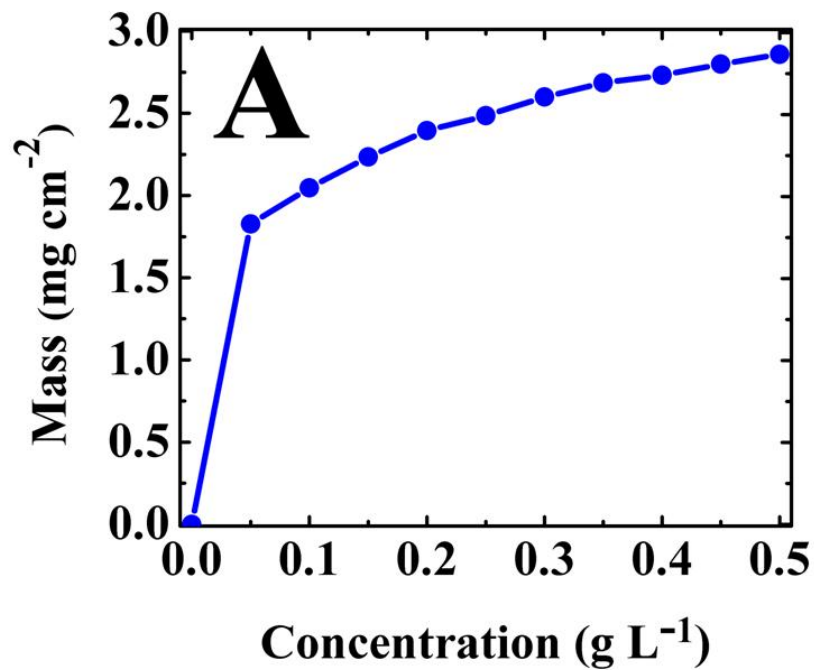


Fig.S3 Deposit mass versus (A) CB concentration at a deposition time of 5 min and (B) deposition time at CB concentration of 0.5 g L<sup>-1</sup> for 4 g L<sup>-1</sup> Y<sub>2</sub>O<sub>3</sub> suspensions.