Supporting Information

Elastomeric nanocomposite foams for the removal of heavy metal ions from water

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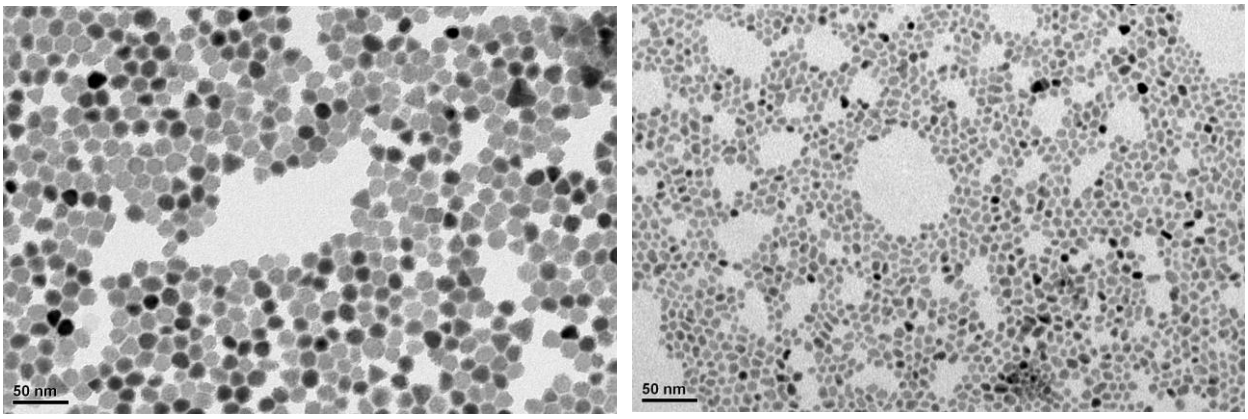
TEM analysis of the ZnSe Nanocrystals

Transmission electron microscopy was performed on JEOL JEM 1011 microscope, equipped with a W thermionic electron source, operating at 100kV. The samples were prepared by dropping 10 μL of diluted solutions of ZnSe NCs onto 150 mesh copper grids coated with carbon film. Then the specimens were placed in air allowing the solvent evaporate. Mean particles size has been measured using Gatan Digital Micrograph software (Gatan Inc, CA). With the first synthetic method, the ZnSe NCs had a mean diameter of 14.368 ± 1.959nm (Figure S1a) and following the second method the NCs were of mean diameter of 6.60 ± 0.98nm (Figure S1b).



(a) **(b)**

Figure S1. TEM analysis for ZnSe NCs in toluene synthesized by (a)the first and (b) the second method as described in the experimental section.

SEM analysis of the PDMS foams

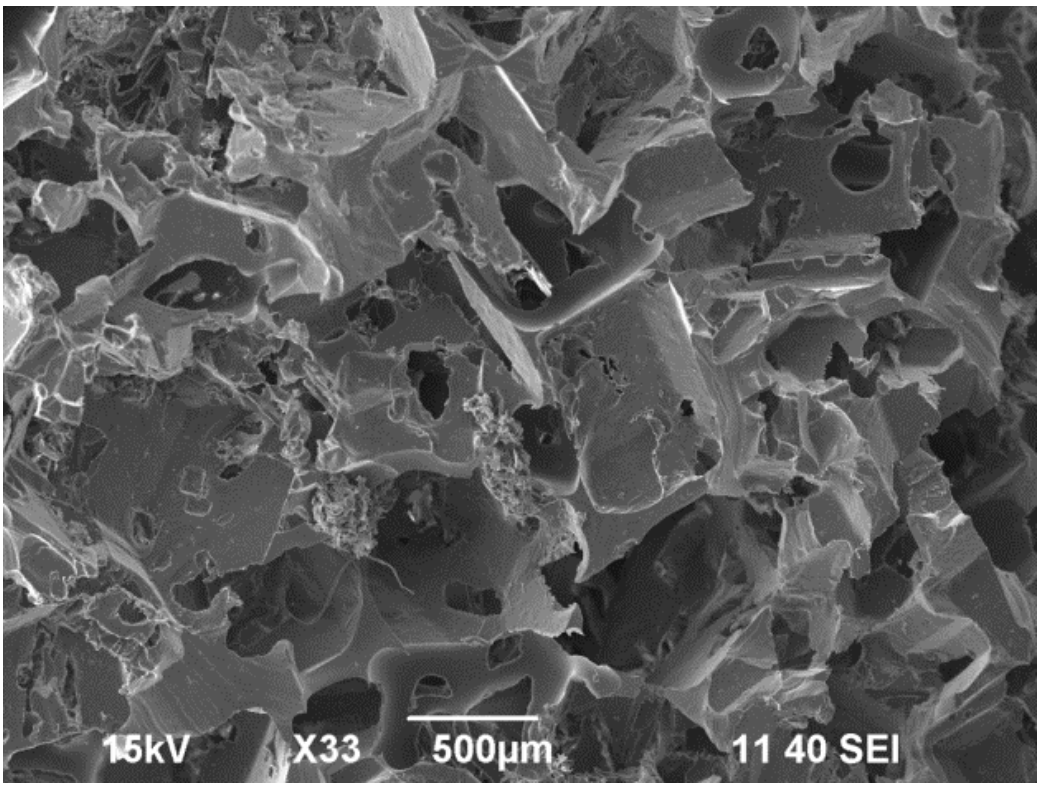


Figure S2. SEM image for the pristine PDMS foam.

Mechanical properties of the PDMS foams

Figure S3 shows the mechanical properties of the pure PDMS foams in two different temperatures. We observed full strain recovery of the foams in all subsequent five compression cycles proving that the fabricated foams have shape memory properties.

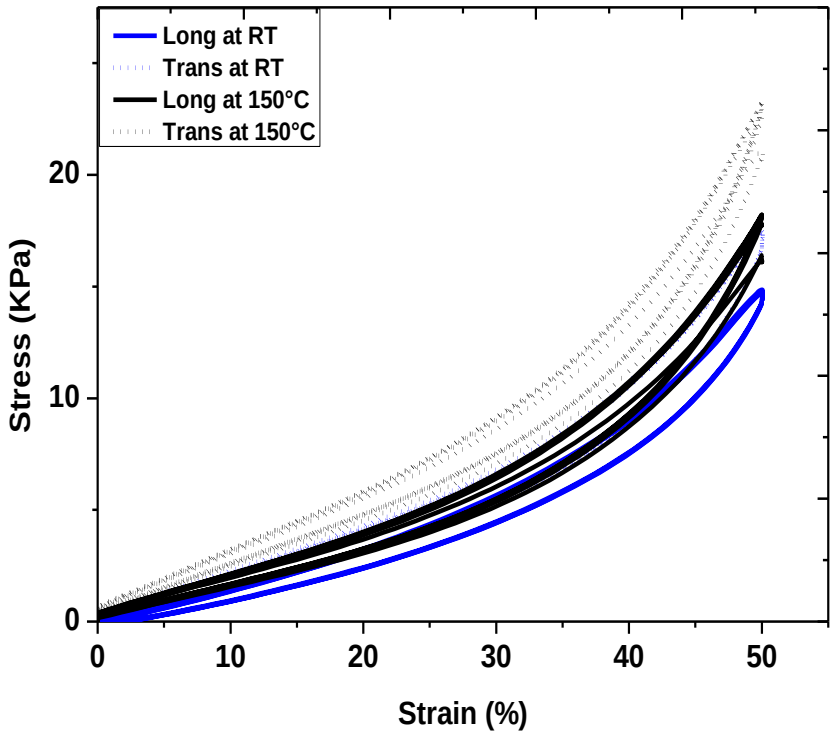
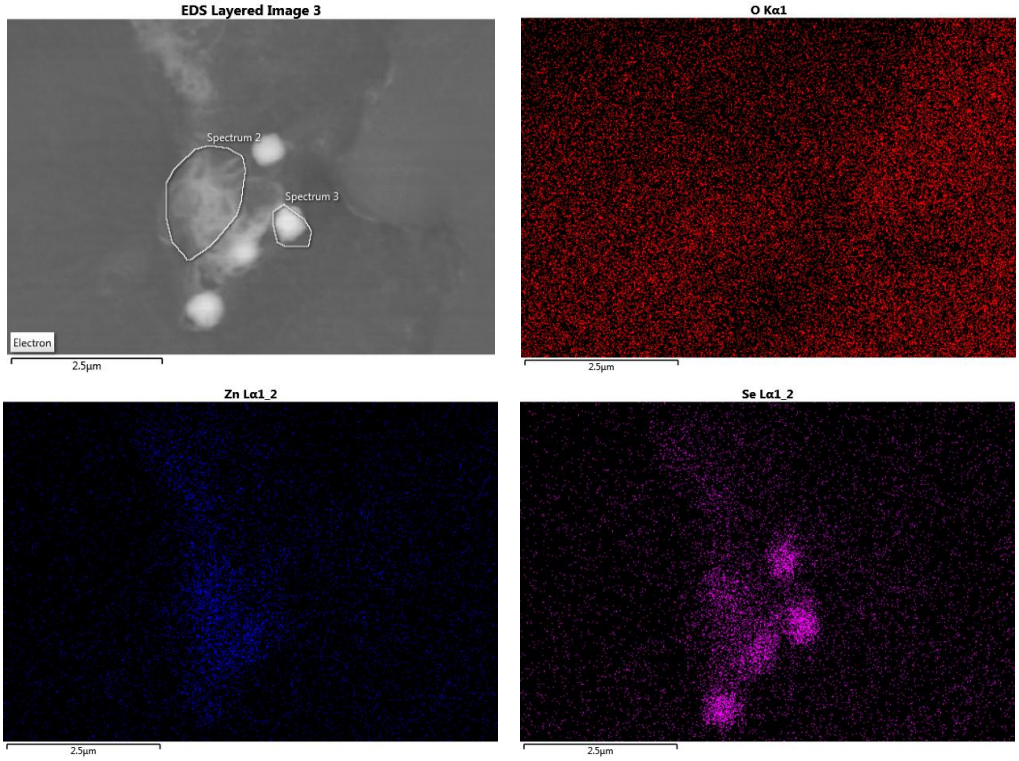


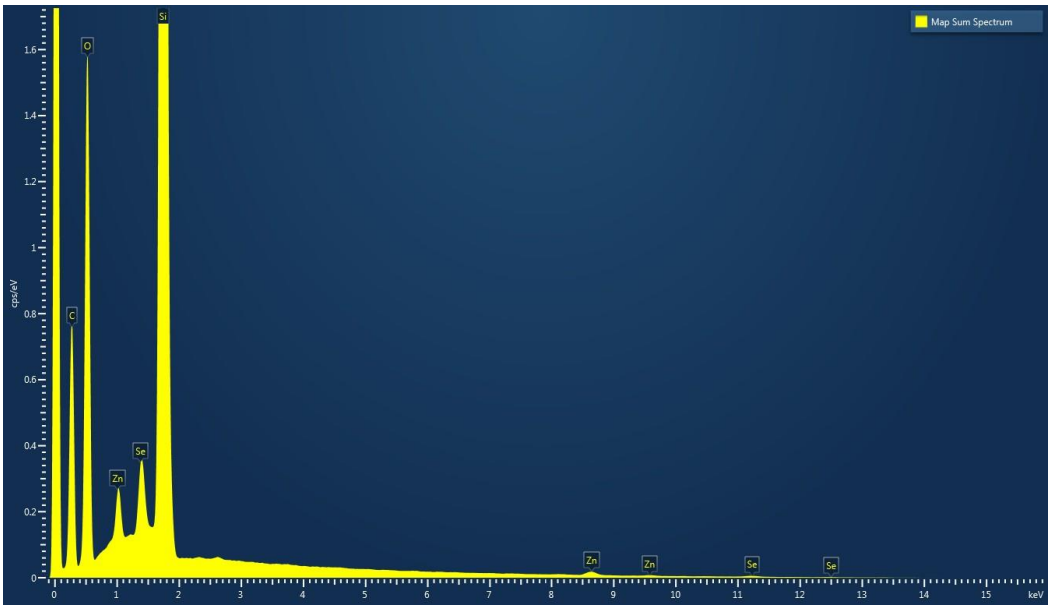
Figure S3. Dynamic mechanical analysis of PDMS foams at room temperature (RT) and 150°C.

Energy-dispersive X-ray spectroscopy (EDS)

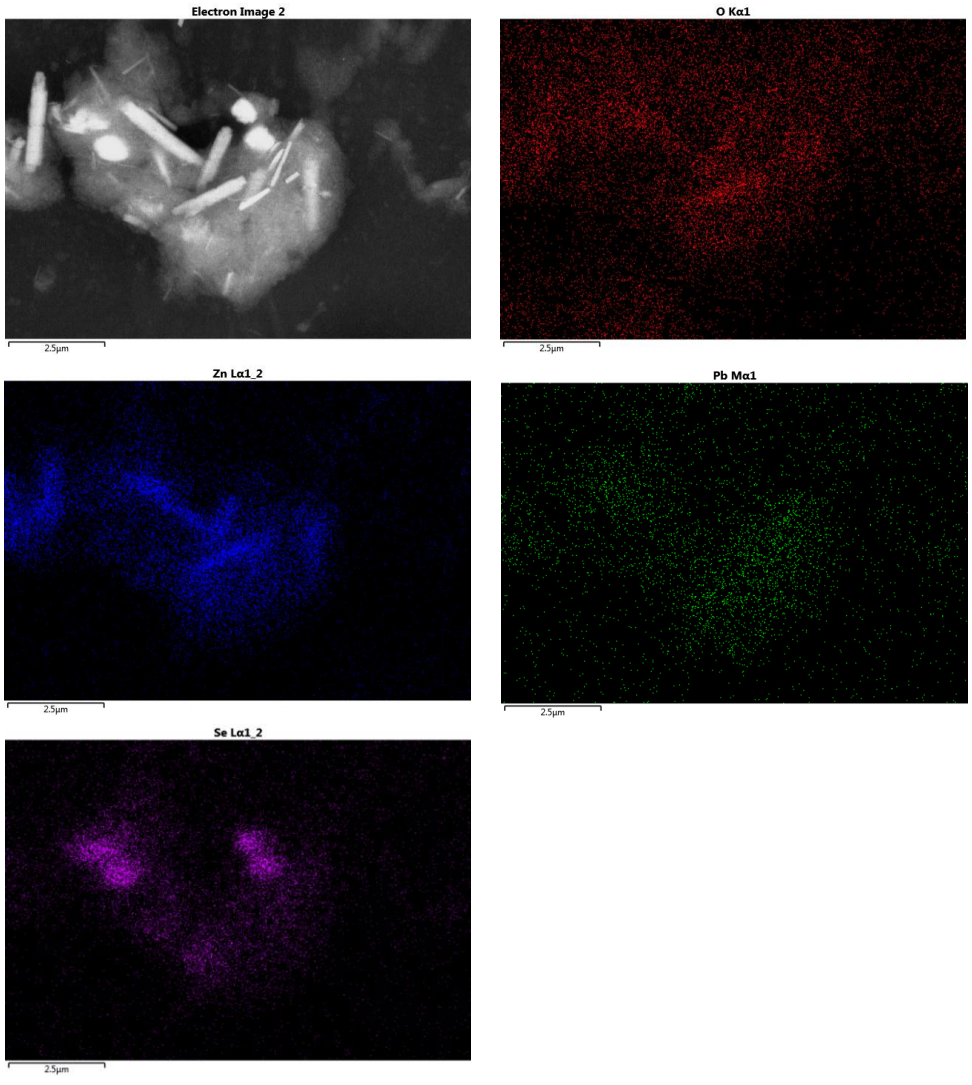
The EDS spectra acquisition for the nanocomposite foams before and after ion exchange reaction was carried. Figure S4a shows the presence of Zn and Se on the ZnSe-PDMS foam before reaction. After the ion exchange reaction (Figure S4b), there is presence Pb on the foam along with Zn and Se.

(a)




Map Sum Spectrum
O
Si
C
Zn
Se
Zn
Zn
Se
Se
cps/eV
keV

(b)


Electron Image 2
O Kα1
Zn Lα1_2
Pb Mα1
Se Lα1_2
2.5µm

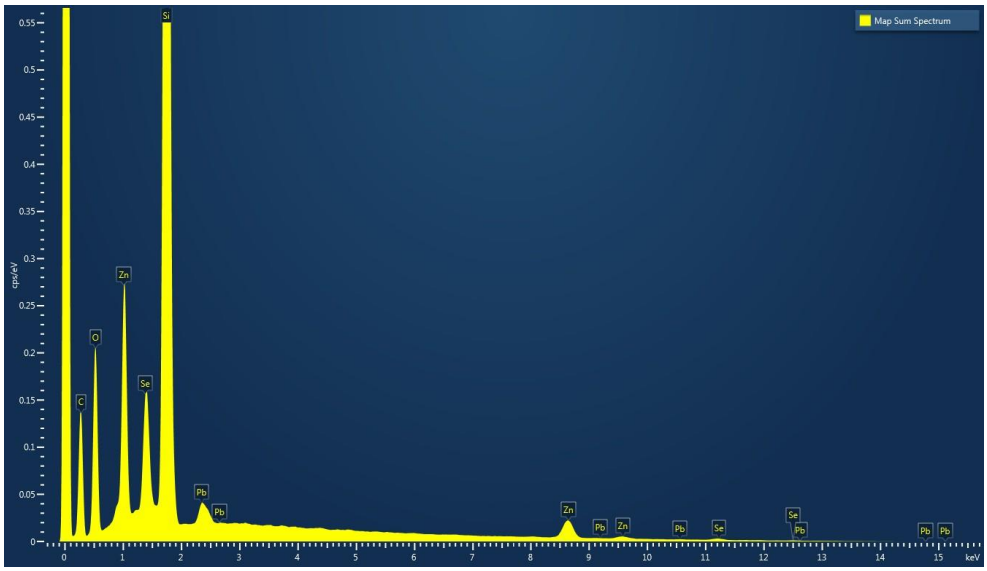


Figure S4. EDS analysis for (a) ZnSe loaded foam (before cation exchange reaction) – mapping shows mainly the presence of Zn and Se; which is also confirmed by the spectrum, (b) ZnSe loaded foam (after exchange reaction) – in the map presence of Pb ions along with the Se peaks, which is also confirmed by the spectrum.

PDMS foams without nanocrystals dipped in polluted water

10mL of 70ppm Pb^{2+} ions in water was stirred with a bare PDMS foam for 24h at room temperature and subsequently the ICP analysis of the water was performed. Figure S5, indicates that there is no change in ppm value for Pb^{2+} ions in water, confirming that there is no effect of the pure hydrophilic PDMS foam on the removal process of metal ions.

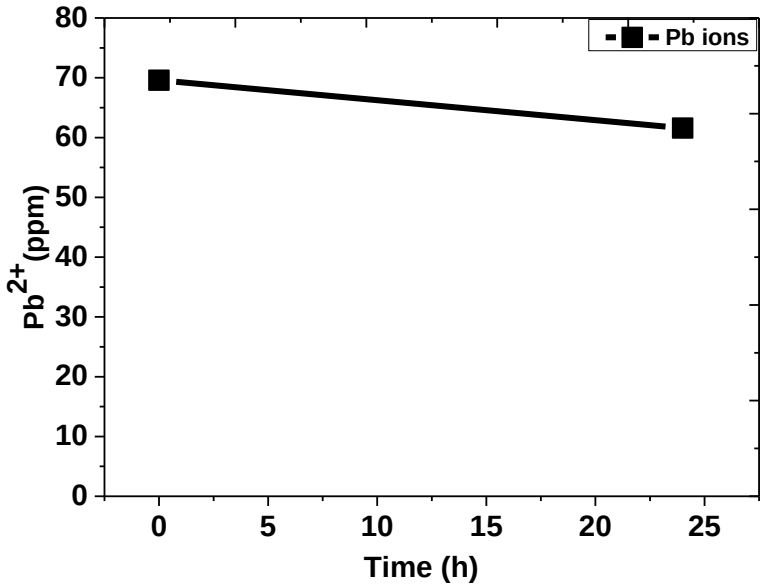


Figure S5. ICP analysis for the presence of Pb^{2+} ions in water treated with a pristine PDMS foam.

Study of ZnSe loaded foam in water (without any metal ions)

To confirm that there is no release of ZnSe NCs in water during the ion exchange process using the NCs-PDMS foam, we placed the foam in pure Milli-Q water, i.e., without any metal ions, for 24h and we subsequently investigated the possible presence of ions in the water. As shown in Figure S6a, b there is a negligible release of Zn^{2+} and Se^{2-} in water.

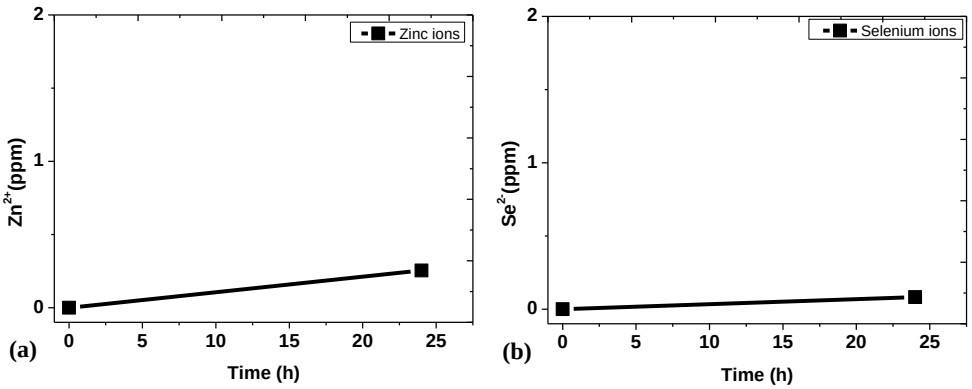


Figure S6. Concentration of the Zn^{2+} (a) and Se^{2-} (b) in water after the removal of the ZnSe-PDMS foam.

Removal of Hg^{2+} in the presence of other metal ions in the wastewater.

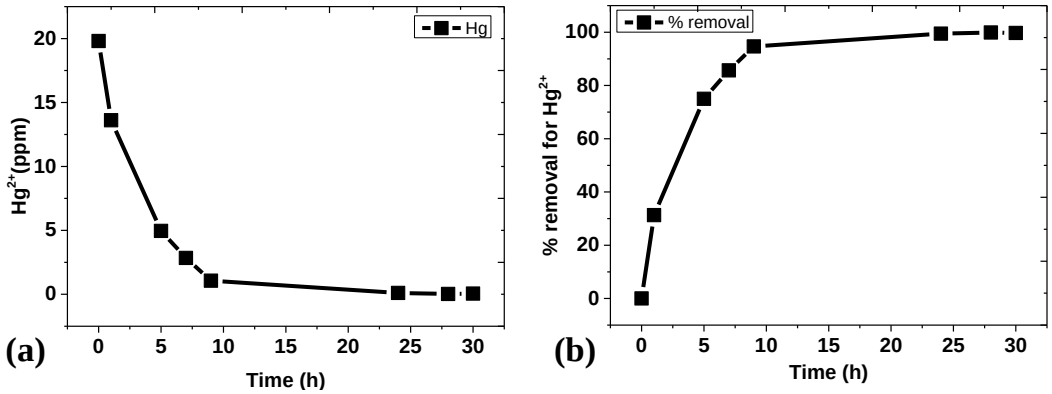


Figure S7. (a) Kinetics of removal of Hg^{2+} ions from polluted water, where also other metal ions are present. (b) The corresponding % removal.