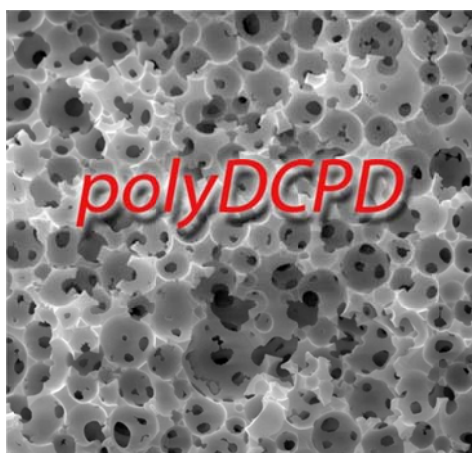# Ring Opening Metathesis Polymerisation of emulsion templated dicyclopentadiene giving polyHIPE materials with excellent mechanical properties

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Electronic Supporting Information

Elemental analyses

(Elementar Vario EL III machine) were performed directly after having dried the samples and after having them stored under ambient conditions for one month.

Mechanical testing

For mechanical testing, emulsions were prepared as written above and were transferred into special stainless steel templates (shouldered test bars, of 9x9 mm (at breaking point) and 140 mm in height). Stretching tests were carried out at room temperature on a Zug/Druck-Universalprüfmachine equipped with a 50 kN load cell. Samples were tested at a rate of 1 mm/min. The mean elastic or Young´s modulus were calculated from data obtained from the initial linear slope of the stress/strain plot with four samples of the same composition.

Porosity

True porosity (experimental porosity; Φ_{exp}) and the window size distribution of each sample were determined by mercury intrusion porosimetry (Micromeritic WIN9400 Series). The skeleton densities were obtained using helium pycnometry (AccuPyc 1330).

Electron microscopy investigations and void size determination

Morphology investigations were done by scanning electron microscopy (SEMs were taken on a JWS-7515, JEOL Ltd. microscope). Micrographs were taken at several magnifications between 2500 X to 7000 X (Figure S1, S2, S3, S4), at 7 mm working distance and 20 kV voltage applied. Piece of the each samples were mounted on a carbon tab for better conductivity and thin layer of gold was sputtered on samples surface prior scanning analysis.

An average voids sizes were determined from SEM micrographs analysis after scanning. Therefore, the mean and the standard deviation were drawn by manual measurements of diameters from a population of at least 40 voids. From SEM images analysis, it is difficult to give a correct evaluation of the void size because the pores are inside the material and during sample sectioning the cavities which appear are at random distance from cavity centre. To get a better estimation of the real void diameter, it is necessary to introduce a statistical correction. Multiplication of the observed voids values from SEM images by statistical factor $2/3^{1/2}$ allows better estimation of real cavity diameters (Table S1).
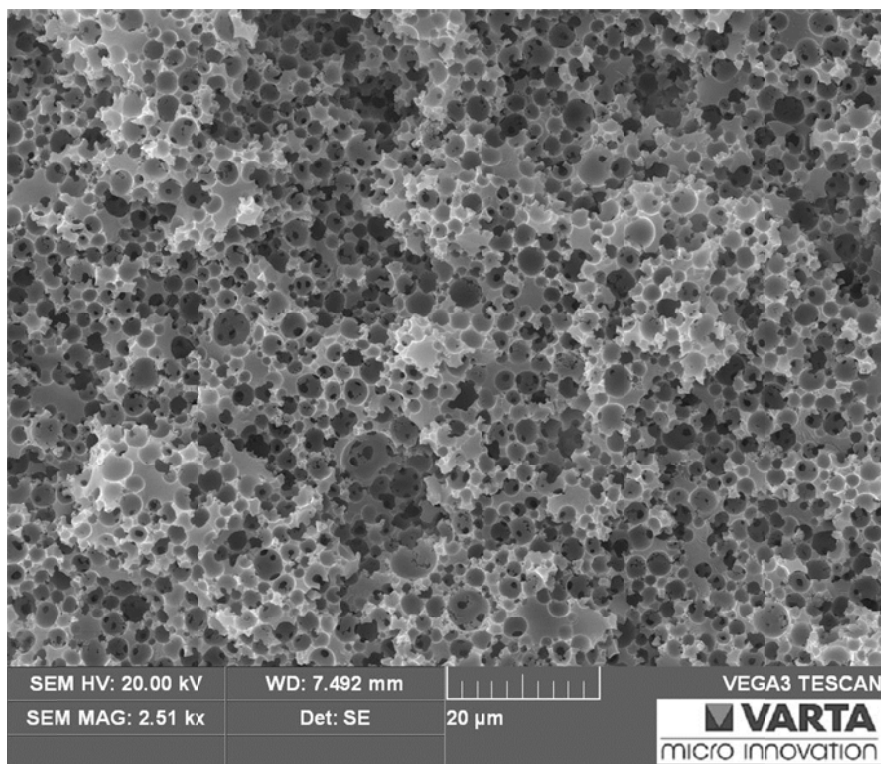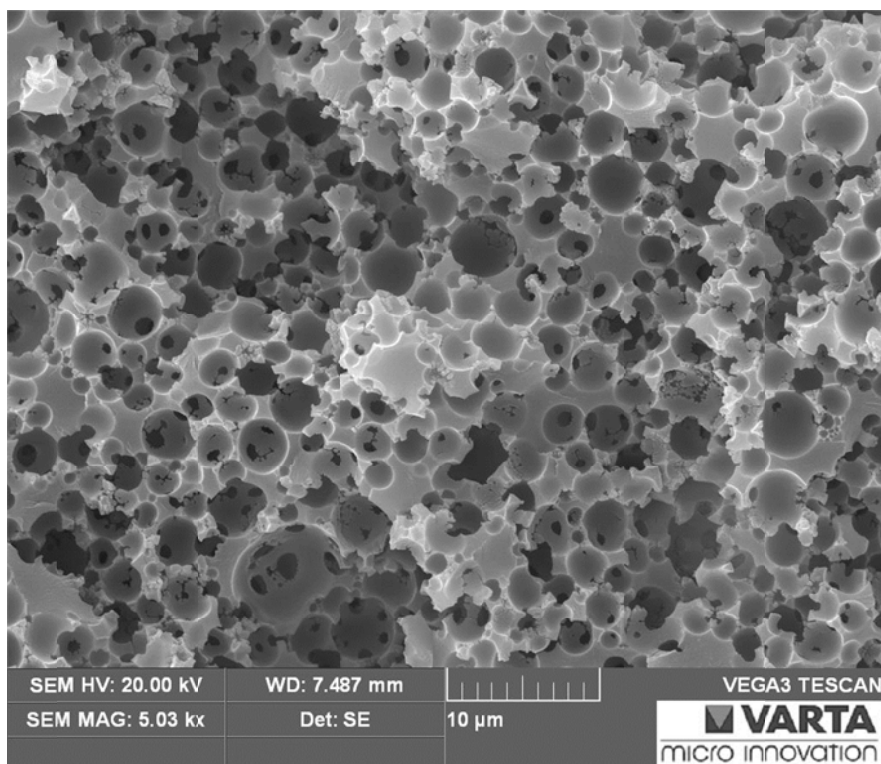
Figure S1a, SEM image of $pDCDP_{50}$
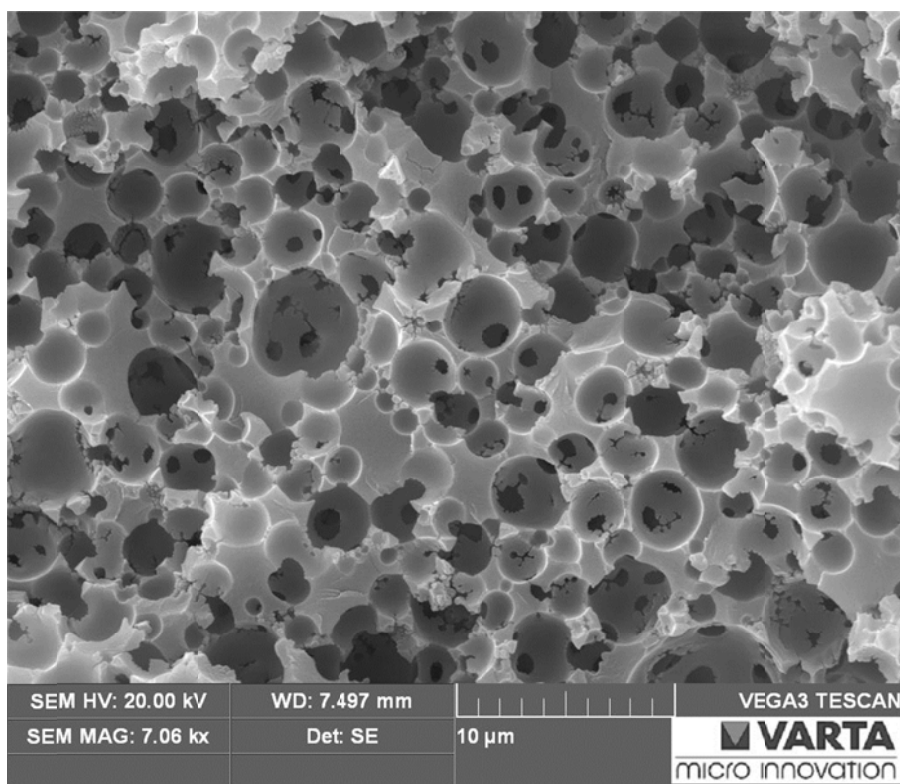

Figure S1b, SEM image of $pDCDP_{50}$

Figure S1c, SEM image of pDCDP$_{50}$
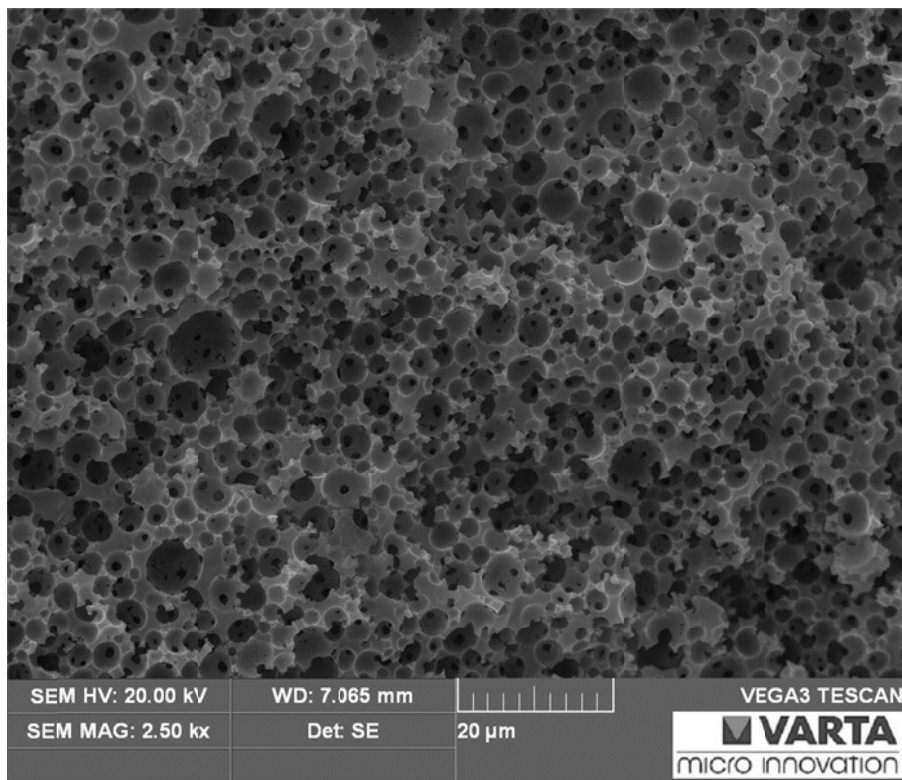
Figure S2a, SEM image of pDCDP$_{60}$

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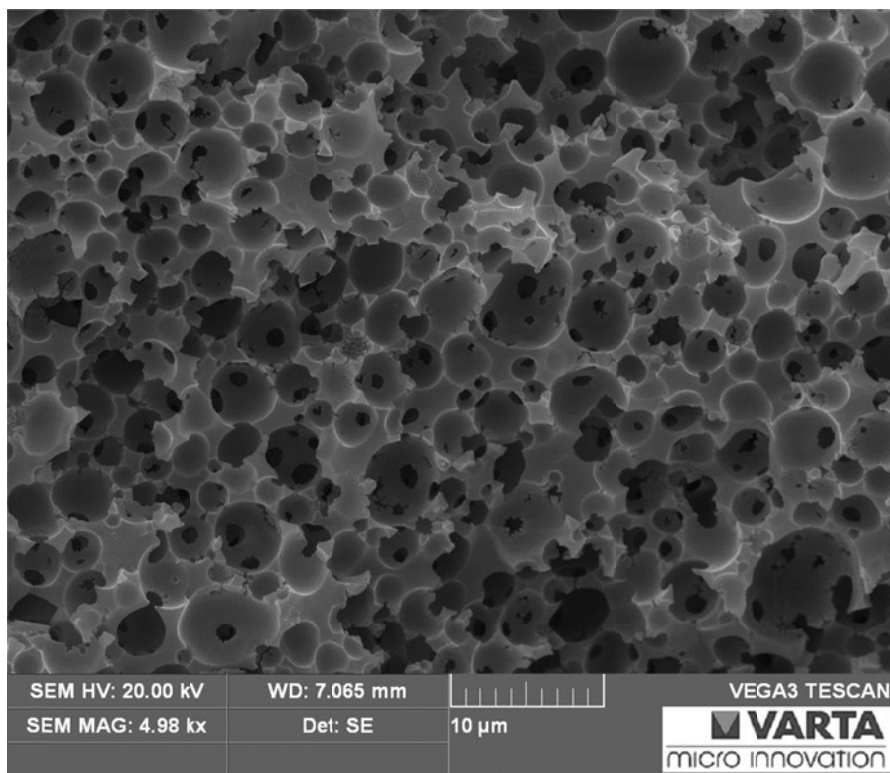
Figure S2b, SEM image of pDCDP$_{60}$
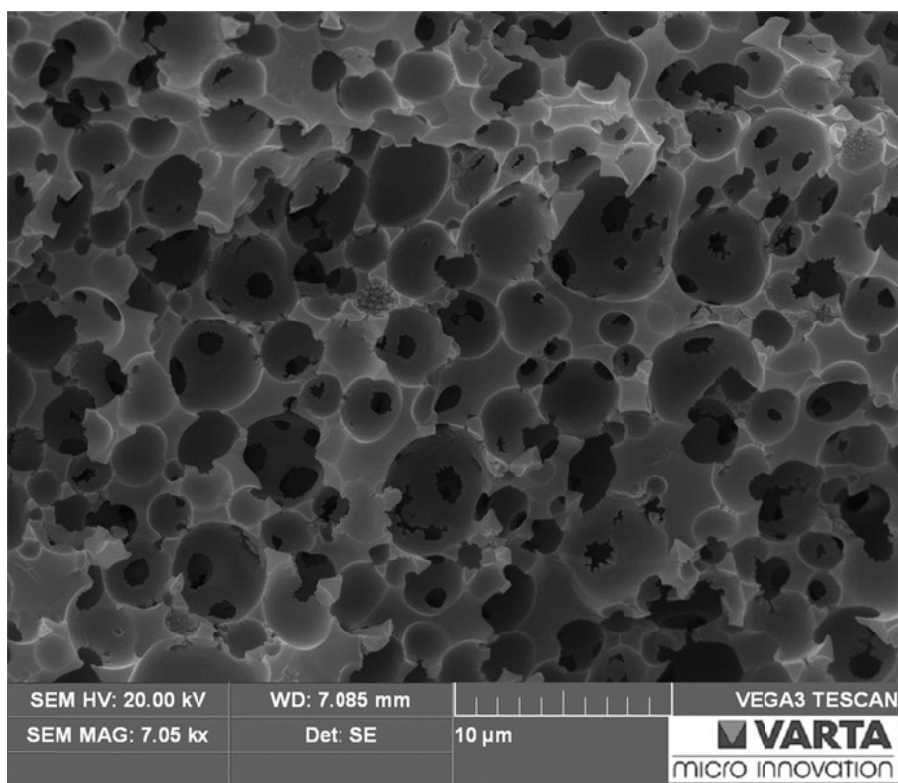
Figure S2c, SEM image of pDCDP$_{60}$
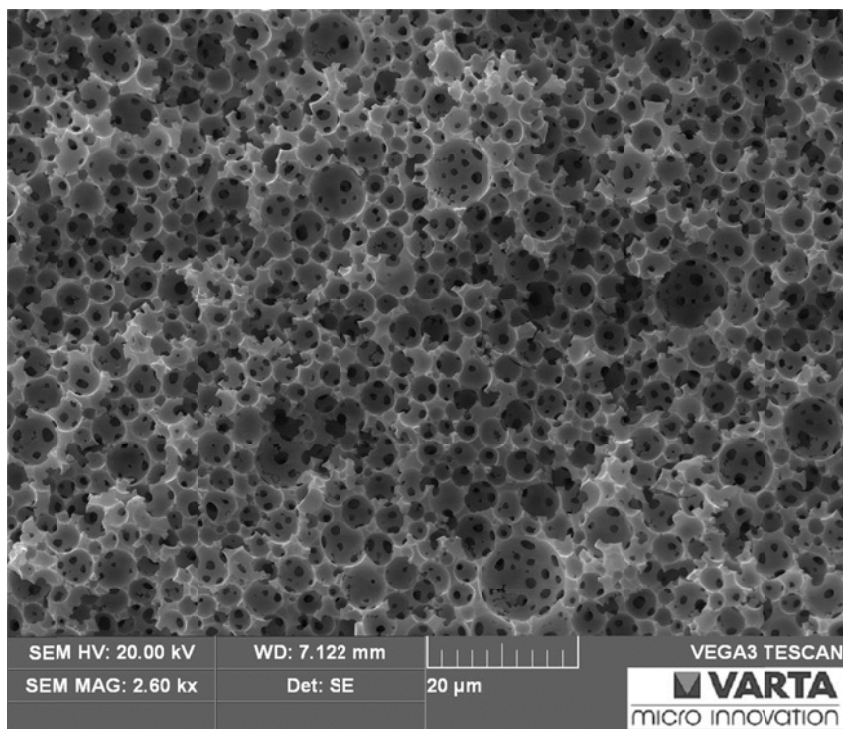
Figure S3a, SEM image of pDCDP$_{70}$
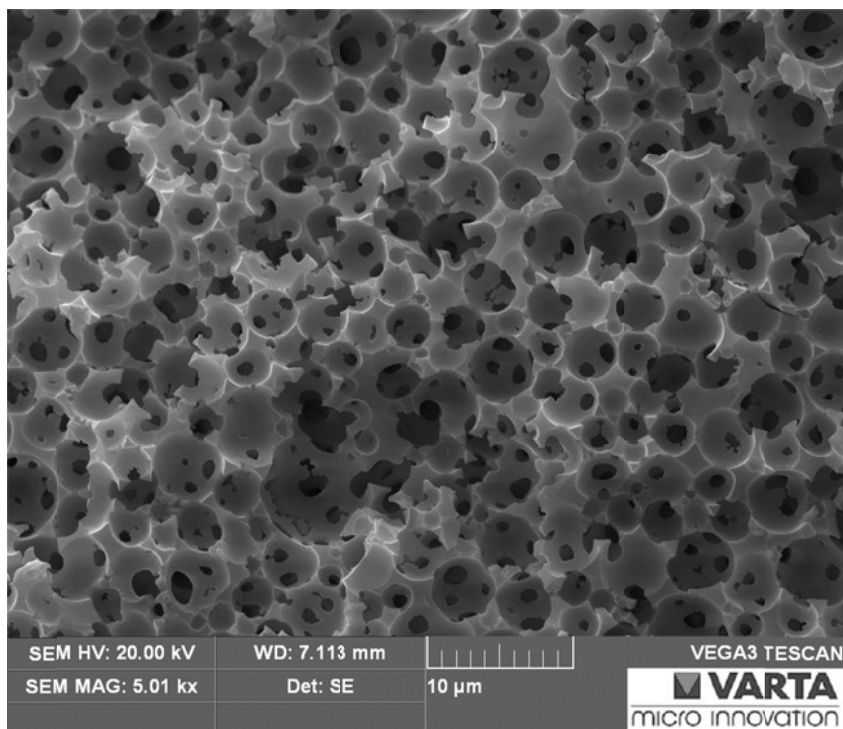
Figure S3b, SEM image of pDCDP$_{70}$
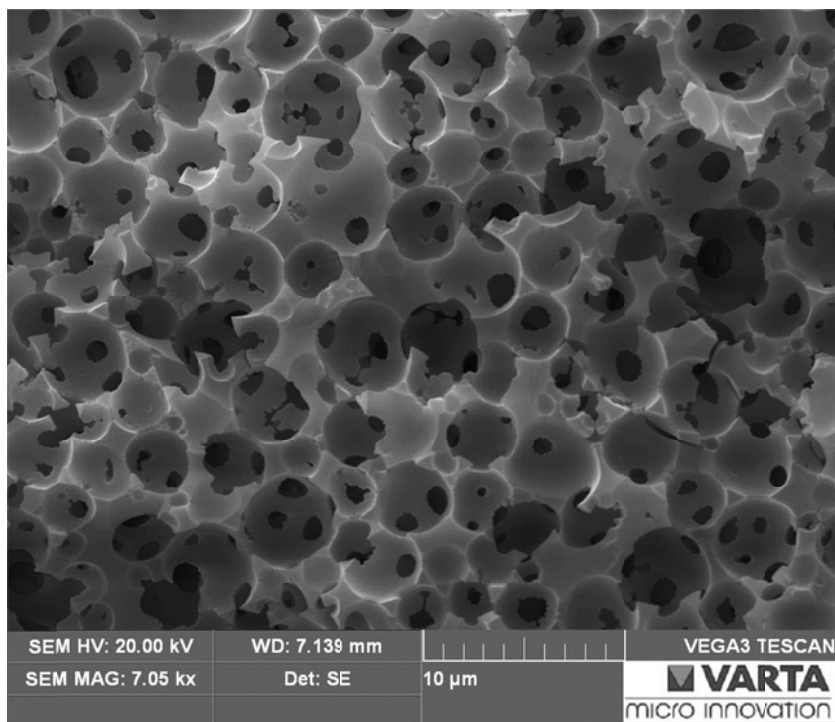
Figure S3c, SEM image of pDCDP$_{70}$
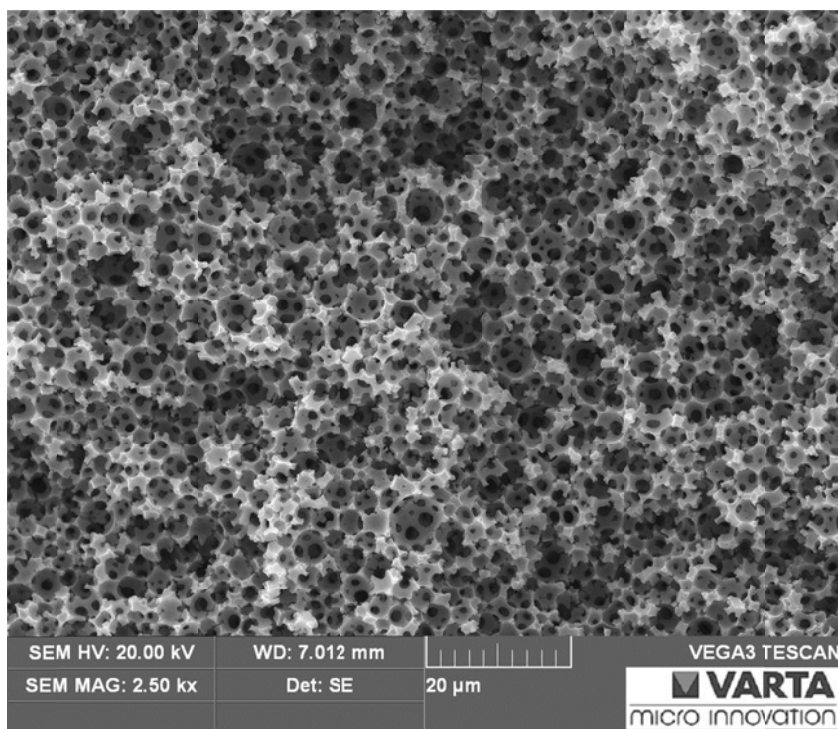
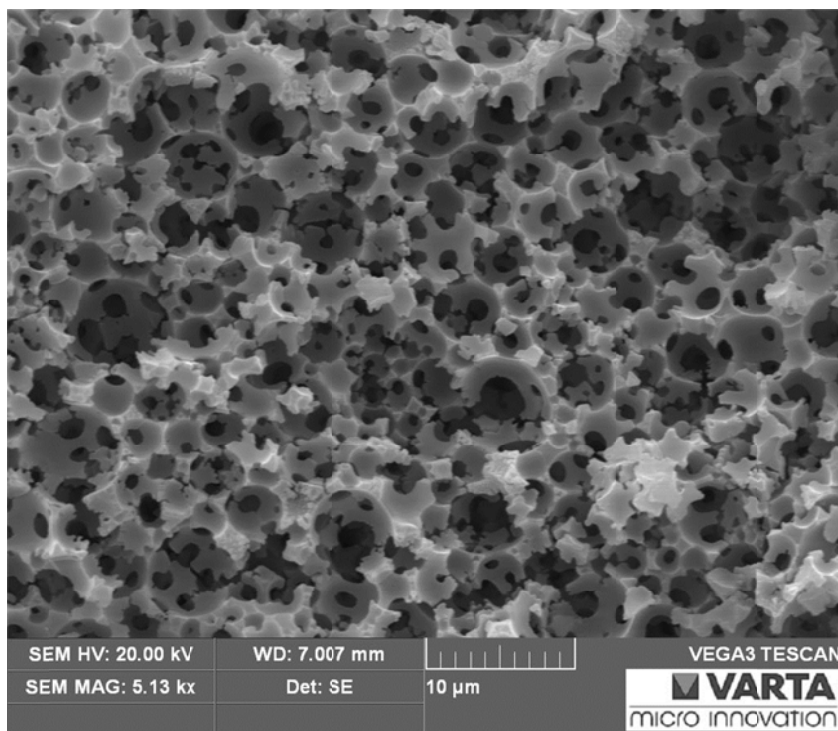**Figure S4a**, SEM image of pDCDP$_{80}$

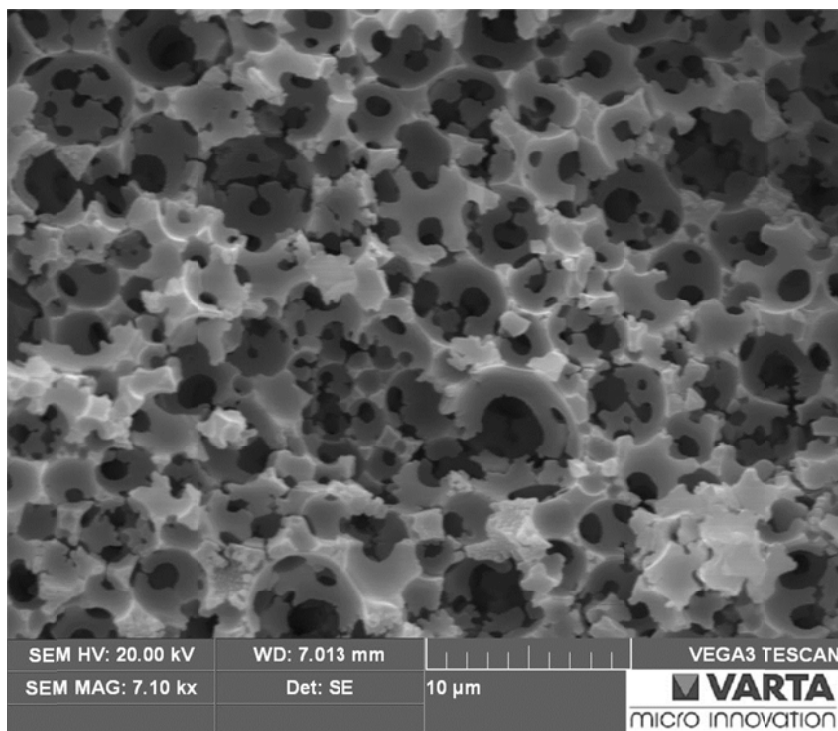**Figure S4b**, SEM image of pDCDP$_{80}$

Figure S4c, SEM image of pDCDP$_{80}$

The porosity analysis

The calculated theoretical porosity of the materials (Φ_{teor}) can be calculated from the dispersed/continuous phase volume ratio assuming complete removal of all the nonpolymerizable components of the emulsion (water phase and surfactant in our case) after the polymerisation. The true or experimental porosity (Φ_{exp}) and interconnect (window) size of the material was estimated by mercury intrusion analysis (results produced by Micromeritic WIN9400 Series machine) (Table S1). A pore size distribution plot also showing contributions from other pore sizes is given in Figure S5.

Table S1. The porosity data of samples

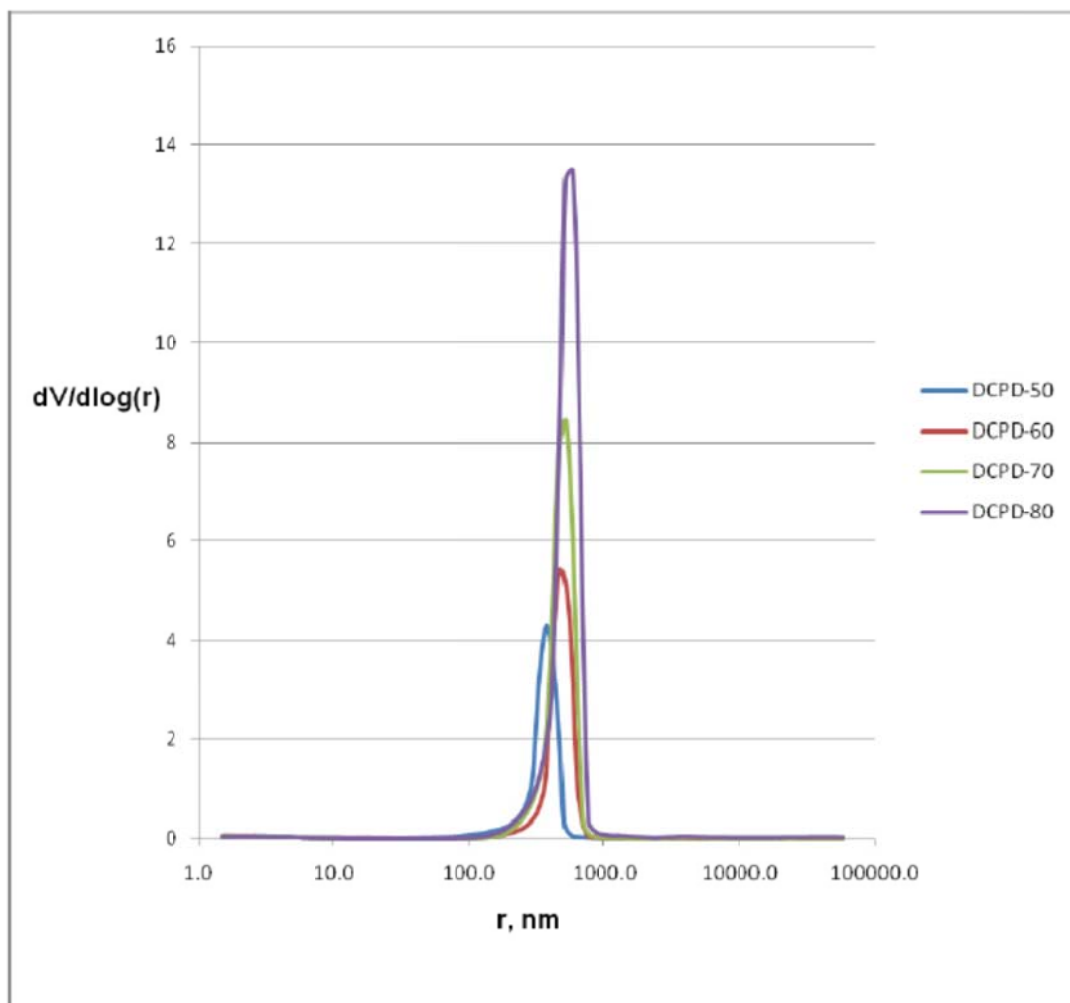| Oxidized samples	$pDCDP_{50}$	$pDCDP_{60}$	$pDCDP_{70}$	$pDCDP_{80}$
$\Phi_{teor.}$ (%)	50	60	70	80
$\Phi_{exp.}$ (%)	55	59	70	80
av. interconnect size (nm)	433	530	726	821
av. pore size (µm)	2.0	4.0	3.6	3.4

Figure S5. Pore size distribution plot of polyDCPD samples.

Oxygen content evaluation of polyDCPD

In the case of non-oxidized sample calculations from elemental analysis reveal oxygen content of the samples right after the preparation and purification (sample stored under vacuum). In the case of oxidized samples calculations from elemental analysis reveal oxygen content of the samples after four weeks of air exposure (Table S2).

Table S2. Elemental analysis of polyDCPD at different porosities

sample	Oxidized			Un-oxidized		
	Elemental analysis			Elemental analysis		
	C[%]	H[%]	O[%]	C[%]	H[%]	O[%]
pDCDP$_{50}$	61	7	32	90	9	1
pDCDP$_{60}$	59	6	35	89	9	2
pDCDP$_{70}$	58	6	36	89	9	2
pDCDP$_{80}$	58	6	36	90	9	1