# Electronic Supplementary Information (ESI)

# Nano-sized Mn oxide as a true catalyst for alcohol oxidation by a mononuclear manganese(II) complex

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## Sample Details

| | | | |
|---|---|---|---|
| **Sample Name:** | 1:1 2 | | |
| **SOP Name:** | cellulose.sop | | |
| **General Notes:** | | | |
| **File Name:** | cellulose.dts | **Dispersant Name:** | Water |
| **Record Number:** | 239 | **Dispersant RI:** | 1.330 |
| **Material RI:** | 1.33 | **Viscosity (cP):** | 0.8872 |
| **Material Absorbtion:** | 0.900 | **Measurement Date and Time:** | Thursday, December 18, 201... |

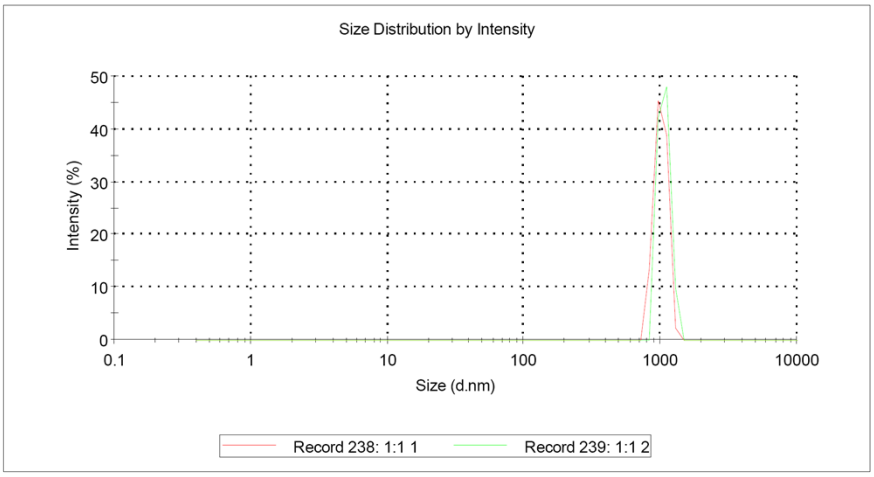
## System

| | | | |
|---|---|---|---|
| **Temperature (°C):** | 24.9 | **Duration Used (s):** | 60 |
| **Count Rate (kcps):** | 172.6 | **Measurement Position (mm):** | 1.25 |
| **Cell Description:** | Glass cuvette with square aper... | **Attenuator:** | 4 |

## Results

| | | | **Size (d.nm):** | **% Intensity** | **Width (d.n...** |
|---|---|---|---|---|---|
| **Z-Average (d.nm):** | 3629 | **Peak 1:** | 1060 | 100.0 | 102.4 |
| **PdI:** | 0.781 | **Peak 2:** | 0.000 | 0.0 | 0.000 |
| **Intercept:** | 0.969 | **Peak 3:** | 0.000 | 0.0 | 0.000 |

**Result quality :** **Refer to quality report**




a

## Sample Details

| | | | |
|---|---|---|---|
| **Sample Name:** | 1:1 2 | | |
| **SOP Name:** | cellulose.sop | | |
| **General Notes:** | | | |
| **File Name:** | cellulose.dts | **Dispersant Name:** | Water |
| **Record Number:** | 239 | **Dispersant RI:** | 1.330 |
| **Material RI:** | 1.33 | **Viscosity (cP):** | 0.8872 |
| **Material Absorbtion:** | 0.900 | **Measurement Date and Time:** | Thursday, December 18, 20... |

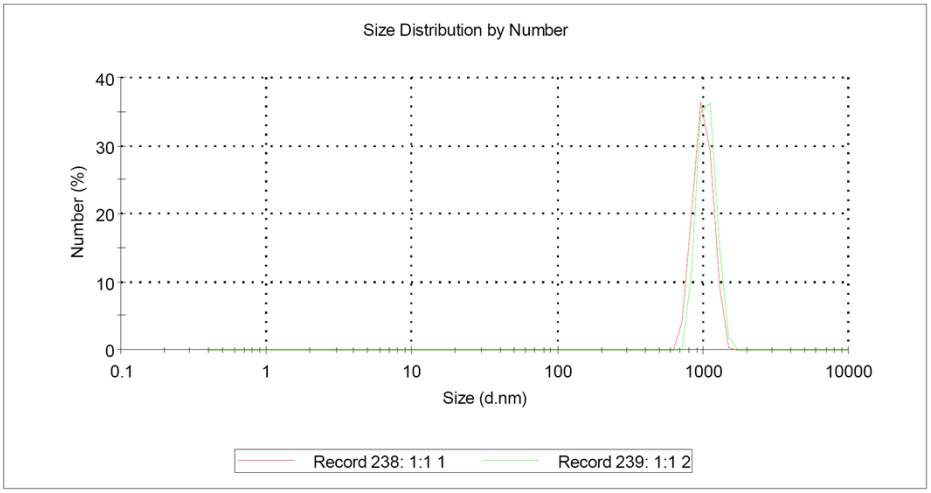
## System

| | | | |
|---|---|---|---|
| **Temperature (°C):** | 24.9 | **Duration Used (s):** | 60 |
| **Count Rate (kcps):** | 172.6 | **Measurement Position (mm):** | 1.25 |
| **Cell Description:** | Glass cuvette with square... | **Attenuator:** | 4 |

## Results

| | | | **Size (d.nm):** | **% Number** | **Width (d.nm...** |
|---|---|---|---|---|---|
| **Z-Average (d.nm):** | 3629 | **Peak 1:** | 1054 | 100.0 | 148.3 |
| **PdI:** | 0.781 | **Peak 2:** | 0.000 | 0.0 | 0.000 |
| **Intercept:** | 0.969 | **Peak 3:** | 0.000 | 0.0 | 0.000 |

**Result quality :** **Refer to quality report**




b

**Sample Details**

| | |
|---|---|
| **Sample Name:** | 1:1 2 |
| **SOP Name:** | cellulose.sop |
| **General Notes:** | |

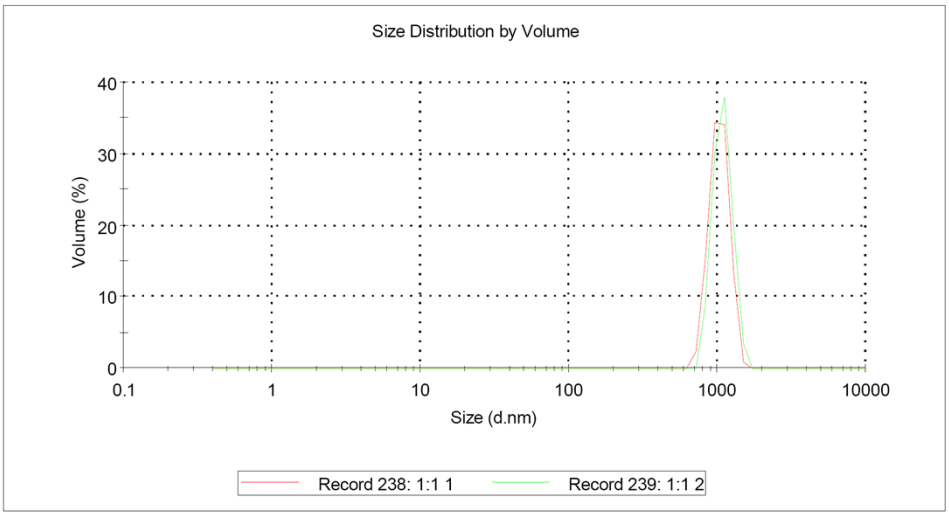
| | | | |
|---|---|---|---|
| **File Name:** | cellulose.dts | **Dispersant Name:** | Water |
| **Record Number:** | 239 | **Dispersant RI:** | 1.330 |
| **Material RI:** | 1.33 | **Viscosity (cP):** | 0.8872 |
| **Material Absorbtion:** | 0.900 | **Measurement Date and Time:** | Thursday, December 18, 20... |

**System**

| | | | |
|---|---|---|---|
| **Temperature (°C):** | 24.9 | **Duration Used (s):** | 60 |
| **Count Rate (kcps):** | 172.6 | **Measurement Position (mm):** | 1.25 |
| **Cell Description:** | Glass cuvette with square ape... | **Attenuator:** | 4 |

**Results**

| | | | **Size (d.nm):** | **% Volume** | **Width (d.n...** |
|---|---|---|---|---|---|
| **Z-Average (d.nm):** | 3629 | **Peak 1:** | 1084 | 100.0 | 155.7 |
| **PdI:** | 0.781 | **Peak 2:** | 0.000 | 0.0 | 0.000 |
| **Intercept:** | 0.969 | **Peak 3:** | 0.000 | 0.0 | 0.000 |
| **Result quality :** | Refer to quality report | | | | |




c

Fig. S1. The DLS result from mixing **1** (1 mL, 4.21 mM), benzyl alcohol (0.25 mL) and Oxone (1 mL, 81 mM) in water after 10 minutes.

## Sample Details

**Sample Name:** 1:2(oxidant 1) 2

**SOP Name:** cellulose.sop

**General Notes:**

| | | | |
|---|---|---|---|
| **File Name:** | cellulose.dts | **Dispersant Name:** | Water |
| **Record Number:** | 243 | **Dispersant RI:** | 1.330 |
| **Material RI:** | 1.33 | **Viscosity (cP):** | 0.8872 |
| **Material Absorbtion:** | 0.363 | **Measurement Date and Time:** | Thursday, December 18, 201... |

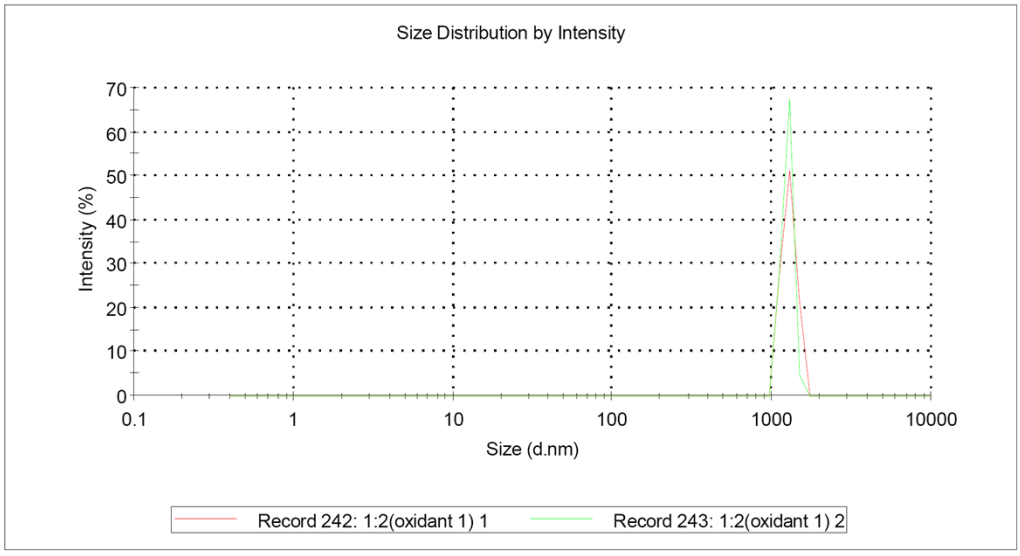
## System

| | | | |
|---|---|---|---|
| **Temperature (°C):** | 24.9 | **Duration Used (s):** | 70 |
| **Count Rate (kcps):** | 165.7 | **Measurement Position (mm):** | 1.25 |
| **Cell Description:** | Glass cuvette with square aper... | **Attenuator:** | 4 |

## Results

| | | | Size (d.nm): | % Intensity | Width (d.n... |
|---|---|---|---|---|---|
| **Z-Average (d.nm):** | 4897 | **Peak 1:** | 1242 | 100.0 | 94.50 |
| **PdI:** | 0.393 | **Peak 2:** | 0.000 | 0.0 | 0.000 |
| **Intercept:** | 1.01 | **Peak 3:** | 0.000 | 0.0 | 0.000 |

**Result quality :** **Refer to quality report**




a

## Sample Details

**Sample Name:** 1:2(oxidant 1) 2

**SOP Name:** cellulose.sop

**General Notes:**

| | | | |
|---|---|---|---|
| **File Name:** | cellulose.dts | **Dispersant Name:** | Water |
| **Record Number:** | 243 | **Dispersant RI:** | 1.330 |
| **Material RI:** | 1.33 | **Viscosity (cP):** | 0.8872 |
| **Material Absorbtion:** | 0.363 | **Measurement Date and Time:** | Thursday, December 18, 20... |

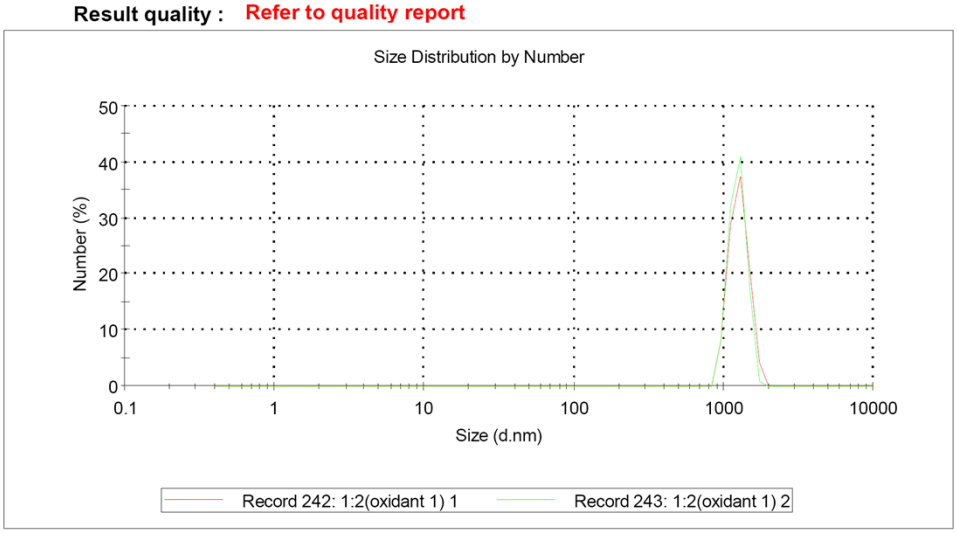
## System

| | | | |
|---|---|---|---|
| **Temperature (°C):** | 24.9 | **Duration Used (s):** | 70 |
| **Count Rate (kcps):** | 165.7 | **Measurement Position (mm):** | 1.25 |
| **Cell Description:** | Glass cuvette with square... | **Attenuator:** | 4 |

## Results

| | | | Size (d.nm): | % Number | Width (d.nm... |
|---|---|---|---|---|---|
| **Z-Average (d.nm):** | 4897 | **Peak 1:** | 1238 | 100.0 | 160.4 |
| **PdI:** | 0.393 | **Peak 2:** | 0.000 | 0.0 | 0.000 |
| **Intercept:** | 1.01 | **Peak 3:** | 0.000 | 0.0 | 0.000 |

**Result quality :** Refer to quality report




b

**Sample Details**

| | |
|---|---|
| **Sample Name:** | 1:2(oxidant 2) 2 |
| **SOP Name:** | cellulose.sop |
| **General Notes:** | |

| | | | |
|---|---|---|---|
| **File Name:** | cellulose.dts | **Dispersant Name:** | Water |
| **Record Number:** | 245 | **Dispersant RI:** | 1.330 |
| **Material RI:** | 1.33 | **Viscosity (cP):** | 0.8872 |
| **Material Absorbtion:** | 0.900 | **Measurement Date and Time:** | Thursday, December 18, 20... |

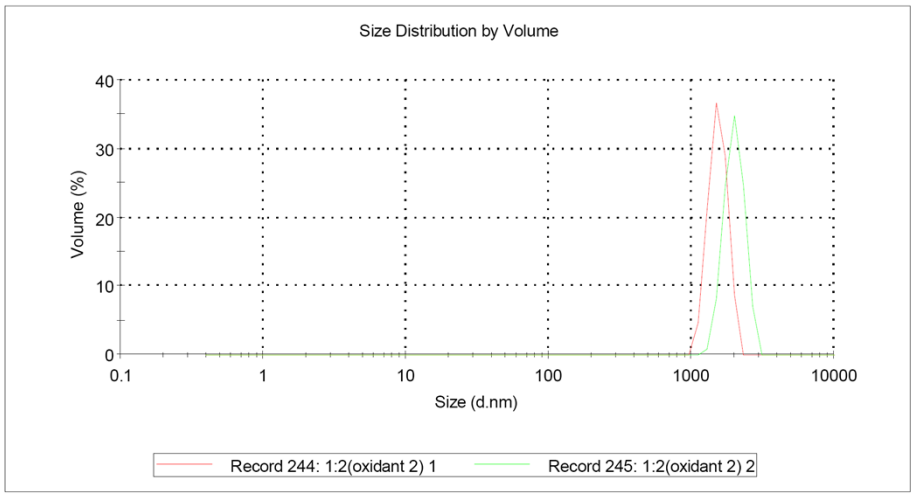
**System**

| | | | |
|---|---|---|---|
| **Temperature (°C):** | 25.0 | **Duration Used (s):** | 60 |
| **Count Rate (kcps):** | 174.5 | **Measurement Position (mm):** | 4.65 |
| **Cell Description:** | Glass cuvette with square ape... | **Attenuator:** | 6 |

**Results**

| | | | **Size (d.nm):** | **% Volume** | **Width (d.n...** |
|---|---|---|---|---|---|
| **Z-Average (d.nm):** | 4045 | **Peak 1:** | 2002 | 100.0 | 316.3 |
| **PdI:** | 0.430 | **Peak 2:** | 0.000 | 0.0 | 0.000 |
| **Intercept:** | 1.01 | **Peak 3:** | 0.000 | 0.0 | 0.000 |

**Result quality :** Refer to quality report




c

Fig. S2. The DLS result from mixing **1** (1 mL, 4.21 mM ), benzyl alcohol (0.25 mL) and Oxone (2 mL, 81 mM) in water minutes.

## Sample Details

**Sample Name:** 1:2(oxidant 2) 2

**SOP Name:** cellulose.sop

**General Notes:**

| | | | |
|---|---|---|---|
| **File Name:** | cellulose.dts | **Dispersant Name:** | Water |
| **Record Number:** | 245 | **Dispersant RI:** | 1.330 |
| **Material RI:** | 1.33 | **Viscosity (cP):** | 0.8872 |
| **Material Absorbtion:** | 0.900 | **Measurement Date and Time:** | Thursday, December 18, 201... |

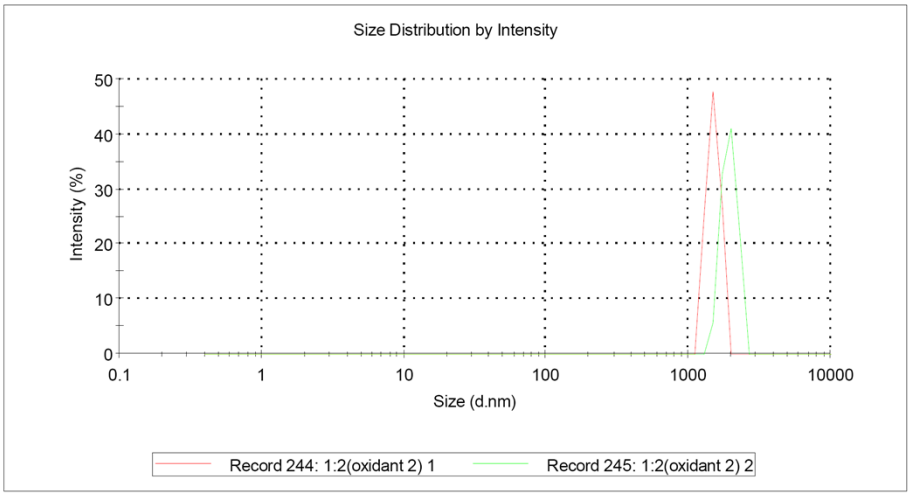
## System

| | | | |
|---|---|---|---|
| **Temperature (°C):** | 25.0 | **Duration Used (s):** | 60 |
| **Count Rate (kcps):** | 174.5 | **Measurement Position (mm):** | 4.65 |
| **Cell Description:** | Glass cuvette with square aper... | **Attenuator:** | 6 |

## Results

| | | | Size (d.nm): | % Intensity | Width (d.n... |
|---|---|---|---|---|---|
| **Z-Average (d.nm):** | 4045 | **Peak 1:** | 1936 | 100.0 | 237.2 |
| **PdI:** | 0.430 | **Peak 2:** | 0.000 | 0.0 | 0.000 |
| **Intercept:** | 1.01 | **Peak 3:** | 0.000 | 0.0 | 0.000 |

**Result quality :** Refer to quality report




a

## Sample Details

| | | | |
|---|---|---|---|
| **Sample Name:** | 1:2(oxidant 2) 2 | | |
| **SOP Name:** | cellulose.sop | | |
| **General Notes:** | | | |
| **File Name:** | cellulose.dts | **Dispersant Name:** | Water |
| **Record Number:** | 245 | **Dispersant RI:** | 1.330 |
| **Material RI:** | 1.33 | **Viscosity (cP):** | 0.8872 |
| **Material Absorbtion:** | 0.900 | **Measurement Date and Time:** | Thursday, December 18, 20... |

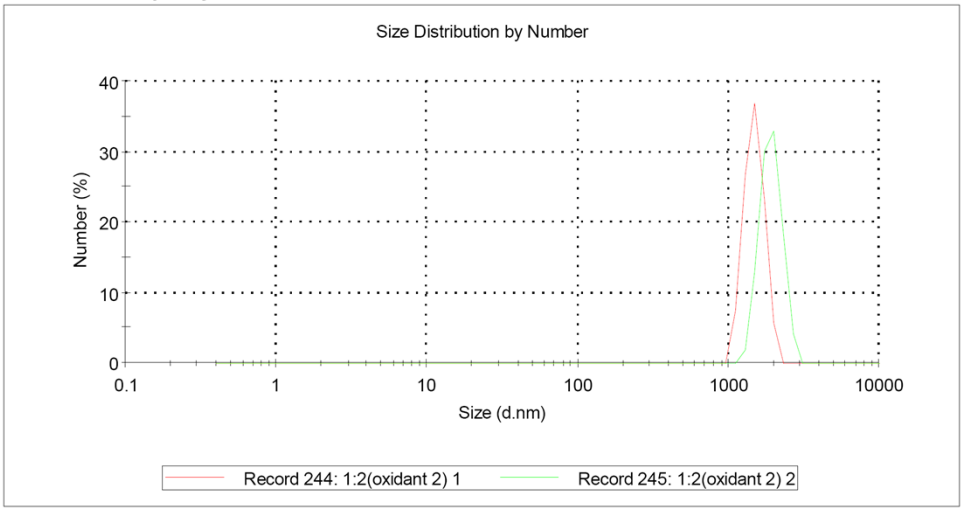
## System

| | | | |
|---|---|---|---|
| **Temperature (°C):** | 25.0 | **Duration Used (s):** | 60 |
| **Count Rate (kcps):** | 174.5 | **Measurement Position (mm):** | 4.65 |
| **Cell Description:** | Glass cuvette with square... | **Attenuator:** | 6 |

## Results

| | | | Size (d.nm): | % Number | Width (d.nm... |
|---|---|---|---|---|---|
| **Z-Average (d.nm):** | 4045 | **Peak 1:** | 1914 | 100.0 | 310.2 |
| **PdI:** | 0.430 | **Peak 2:** | 0.000 | 0.0 | 0.000 |
| **Intercept:** | 1.01 | **Peak 3:** | 0.000 | 0.0 | 0.000 |

**Result quality :** Refer to quality report




b

**Sample Details**

| | | | |
|---|---|---|---|
| **Sample Name:** | 1:2(oxidant 2) 2 | | |
| **SOP Name:** | cellulose.sop | | |
| **General Notes:** | | | |
| **File Name:** | cellulose.dts | **Dispersant Name:** | Water |
| **Record Number:** | 245 | **Dispersant RI:** | 1.330 |
| **Material RI:** | 1.33 | **Viscosity (cP):** | 0.8872 |
| **Material Absorbtion:** | 0.900 | **Measurement Date and Time:** | Thursday, December 18, 20... |

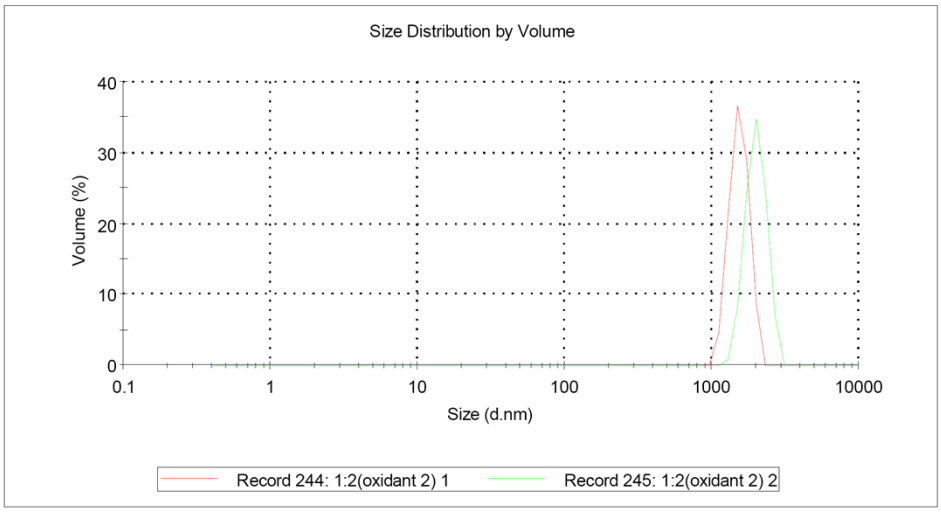
**System**

| | | | |
|---|---|---|---|
| **Temperature (°C):** | 25.0 | **Duration Used (s):** | 60 |
| **Count Rate (kcps):** | 174.5 | **Measurement Position (mm):** | 4.65 |
| **Cell Description:** | Glass cuvette with square ape... | **Attenuator:** | 6 |

**Results**

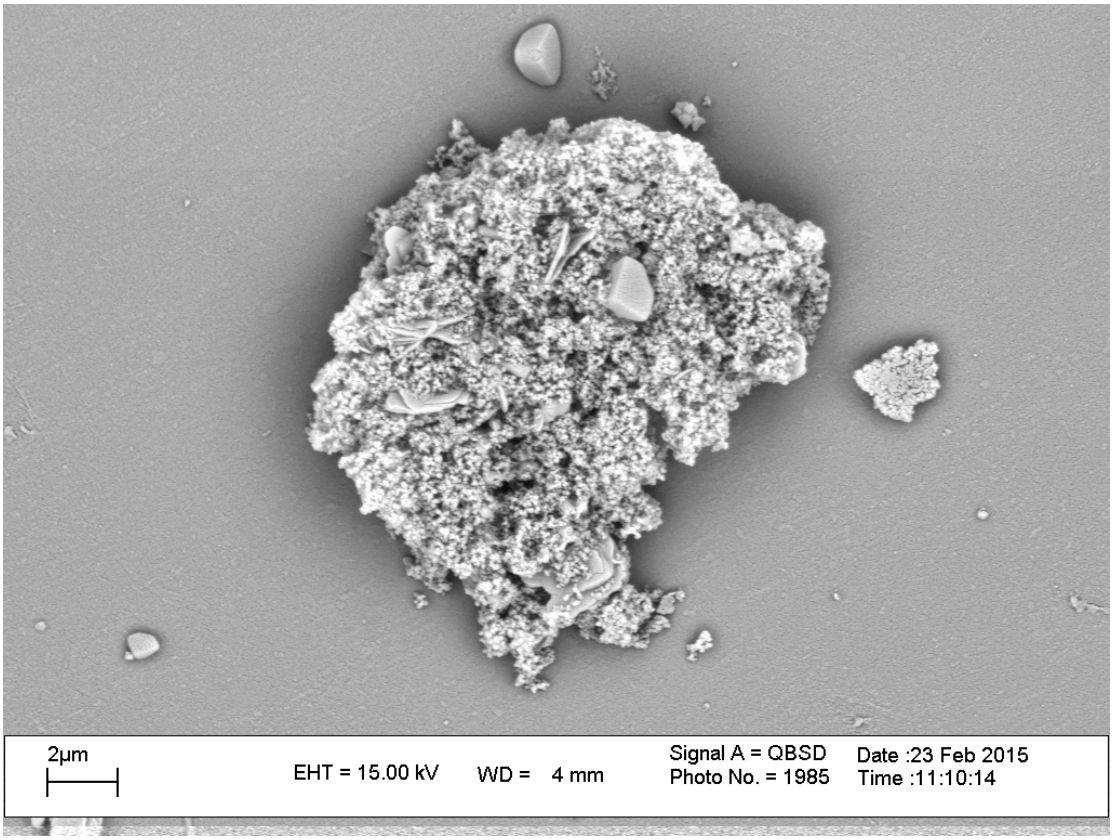
| | | | **Size (d.nm):** | **% Volume** | **Width (d.n...** |
|---|---|---|---|---|---|
| **Z-Average (d.nm):** | 4045 | **Peak 1:** | 2002 | 100.0 | 316.3 |
| **PdI:** | 0.430 | **Peak 2:** | 0.000 | 0.0 | 0.000 |
| **Intercept:** | 1.01 | **Peak 3:** | 0.000 | 0.0 | 0.000 |

**Result quality :** **Refer to quality report**

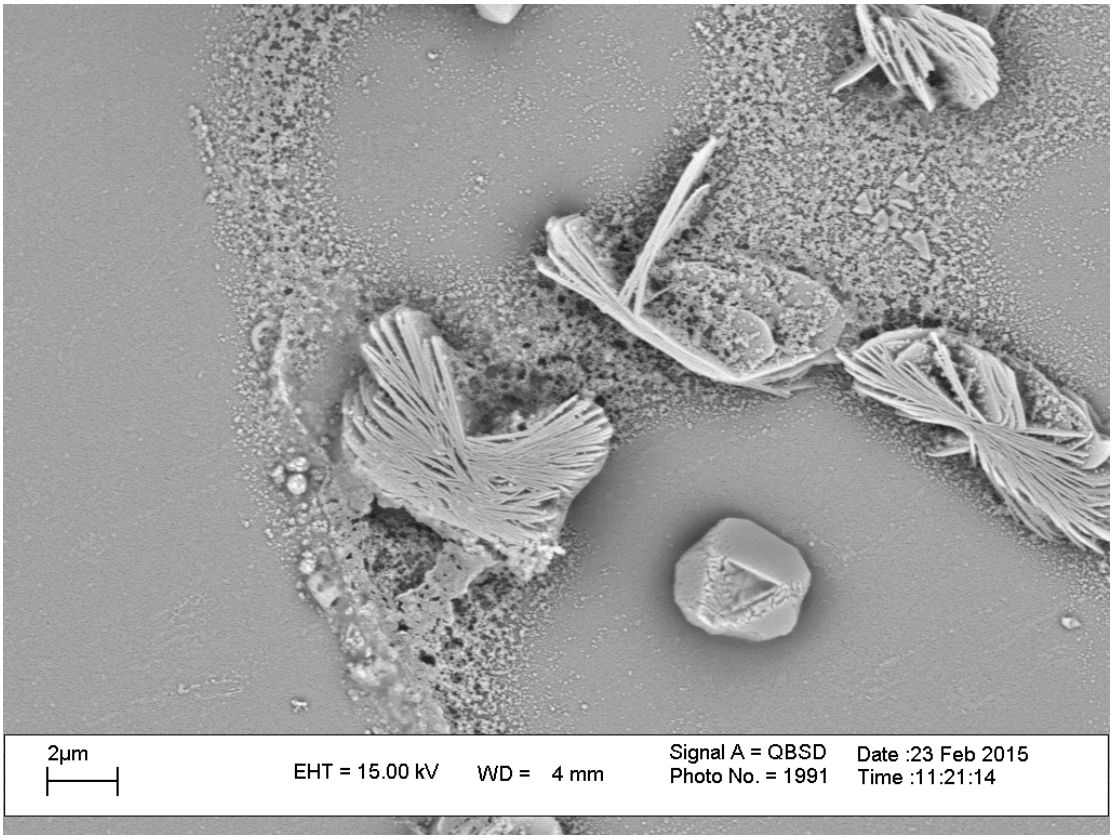



c

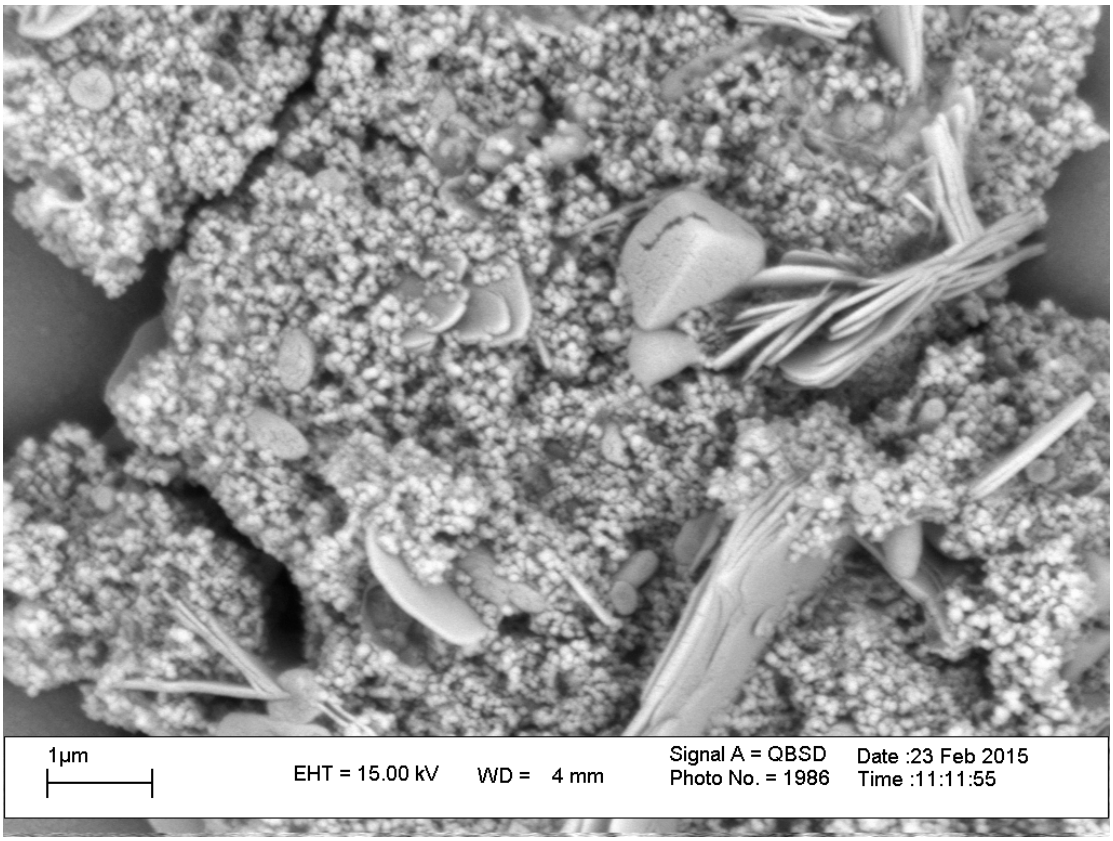
Fig. S3. The DLS result from mixing **1** (1ml, 4.21 mM), benzyl alcohol (0.25 mL) and Oxone ® tetrabutylammonium (2 mL, 26 mM) in acetonitrile after 10 minutes.


2µm
EHT = 15.00 kV
WD = 4 mm
Signal A = QBSD
Photo No. = 1985
Date :23 Feb 2015
Time :11:10:14

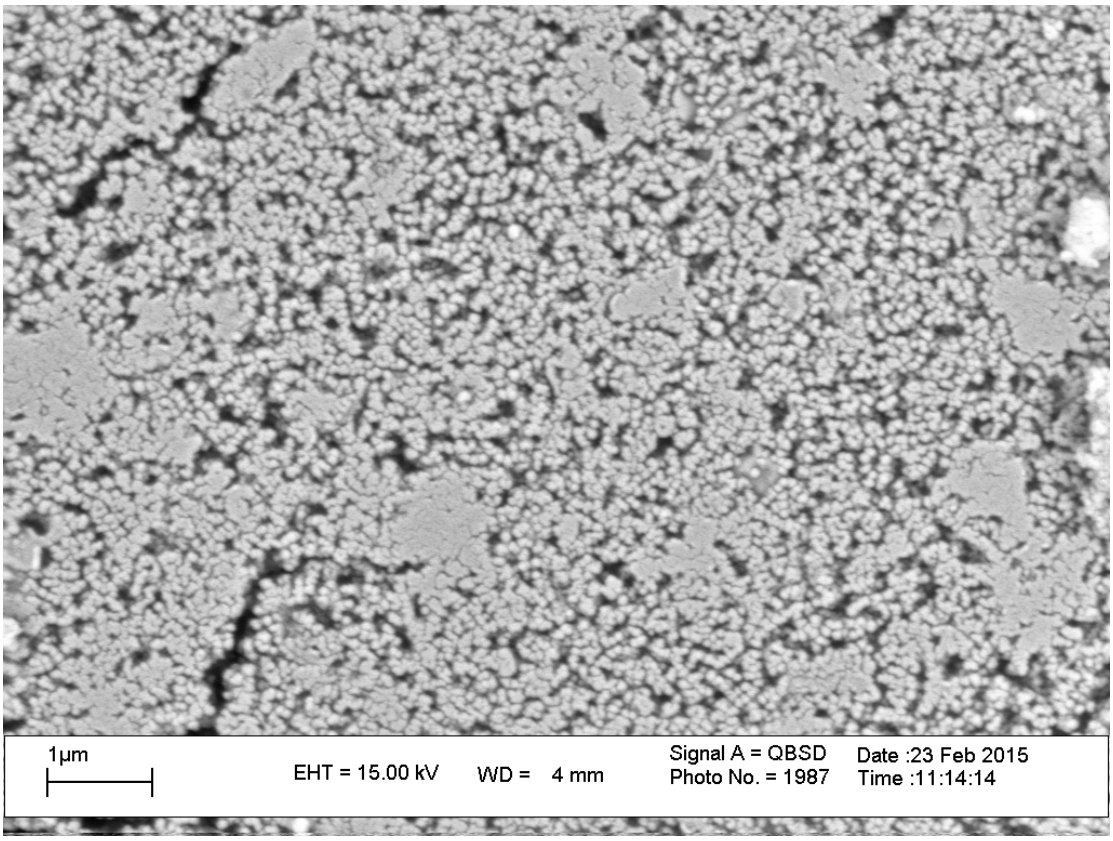
a


2µm
EHT = 15.00 kV
WD = 4 mm
Signal A = QBSD
Photo No. = 1991
Date :23 Feb 2015
Time :11:21:14

b

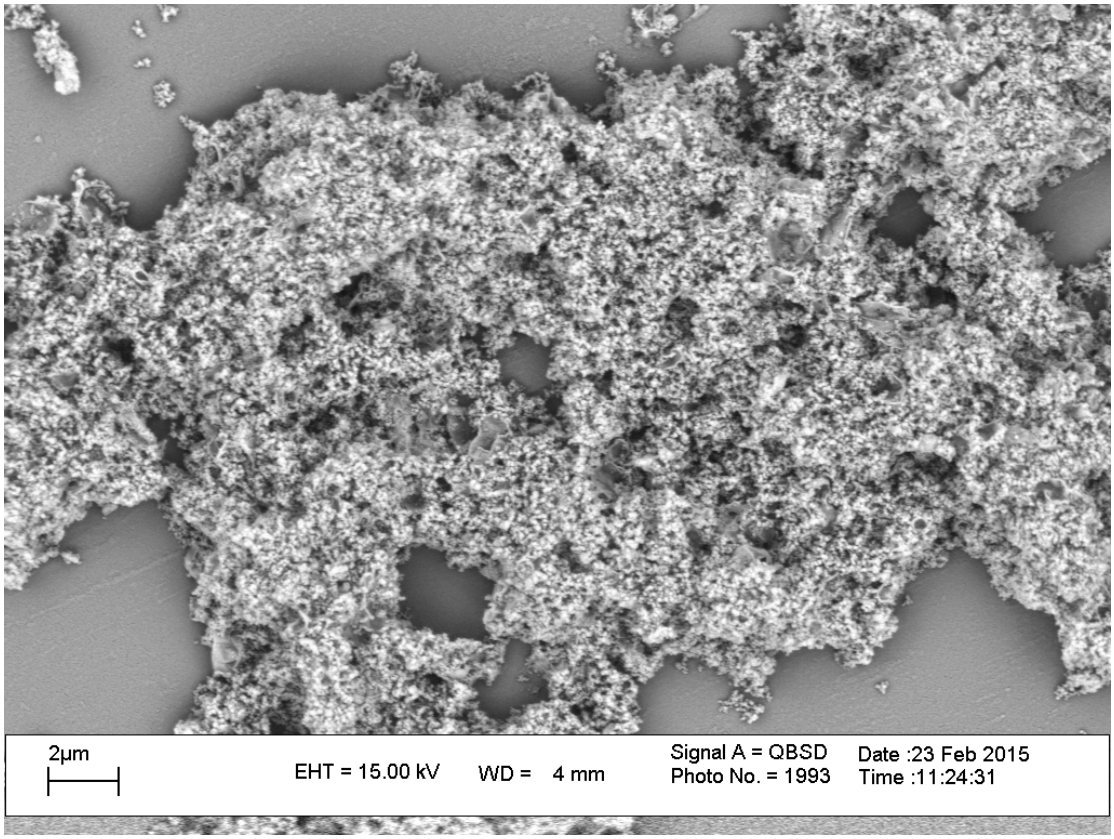



c

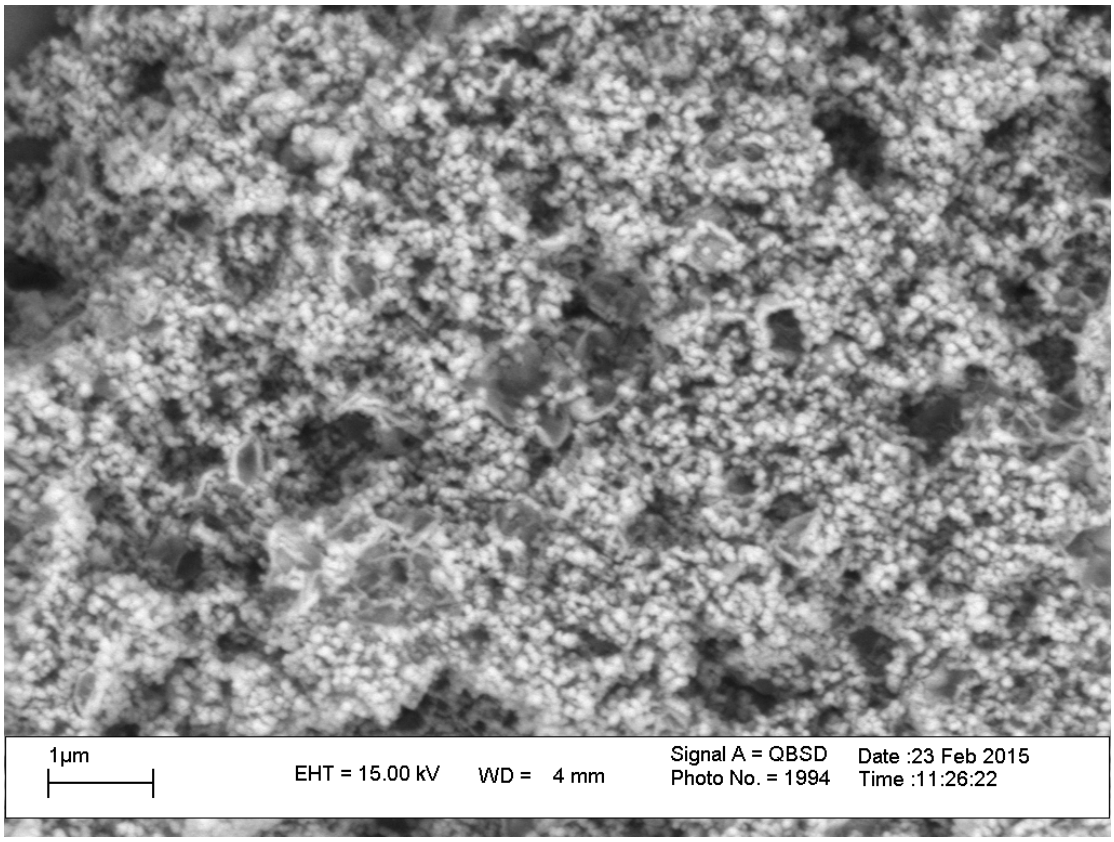



d

Fig. S4. SEM image from mixing **1** (1 mL, 4.21 mM), benzyl alcohol (0.25 mL) and Oxone (2 mL, 81 mM) in water after 10 minutes (a-d). The centrifuged particles were washed carefully with solvent before considering by SEM.

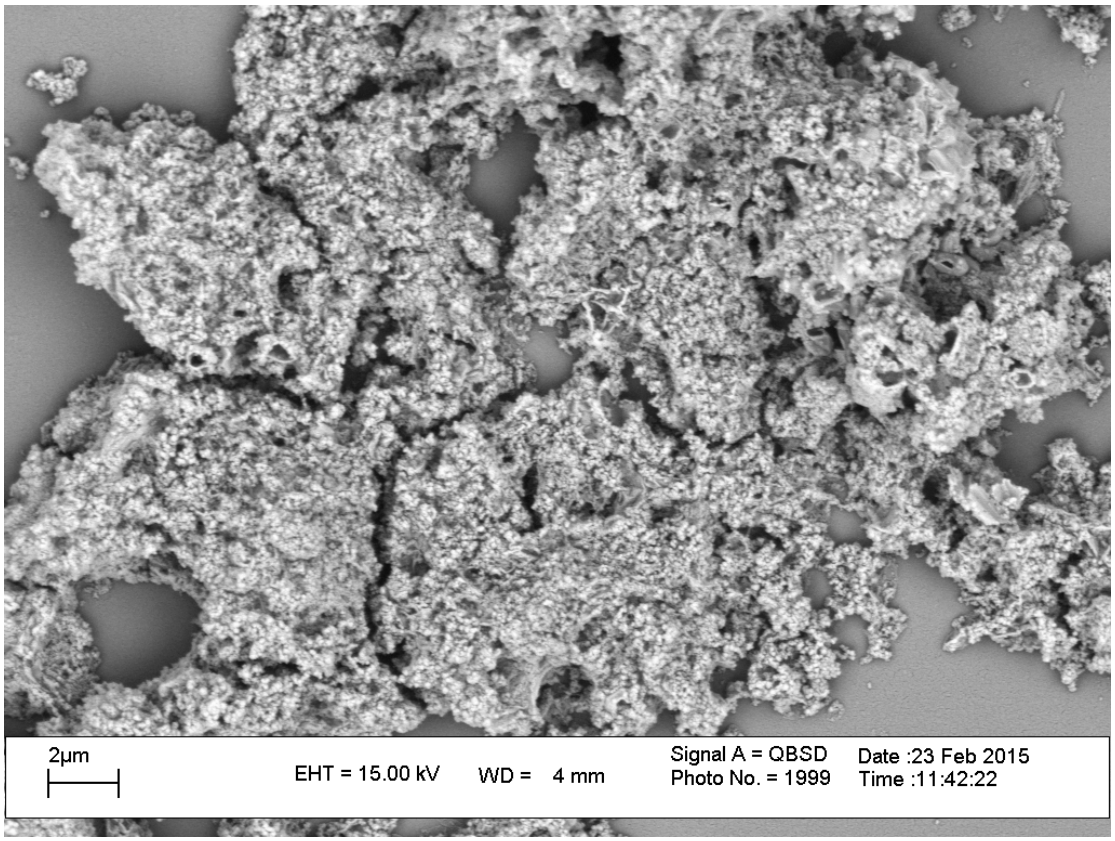



a

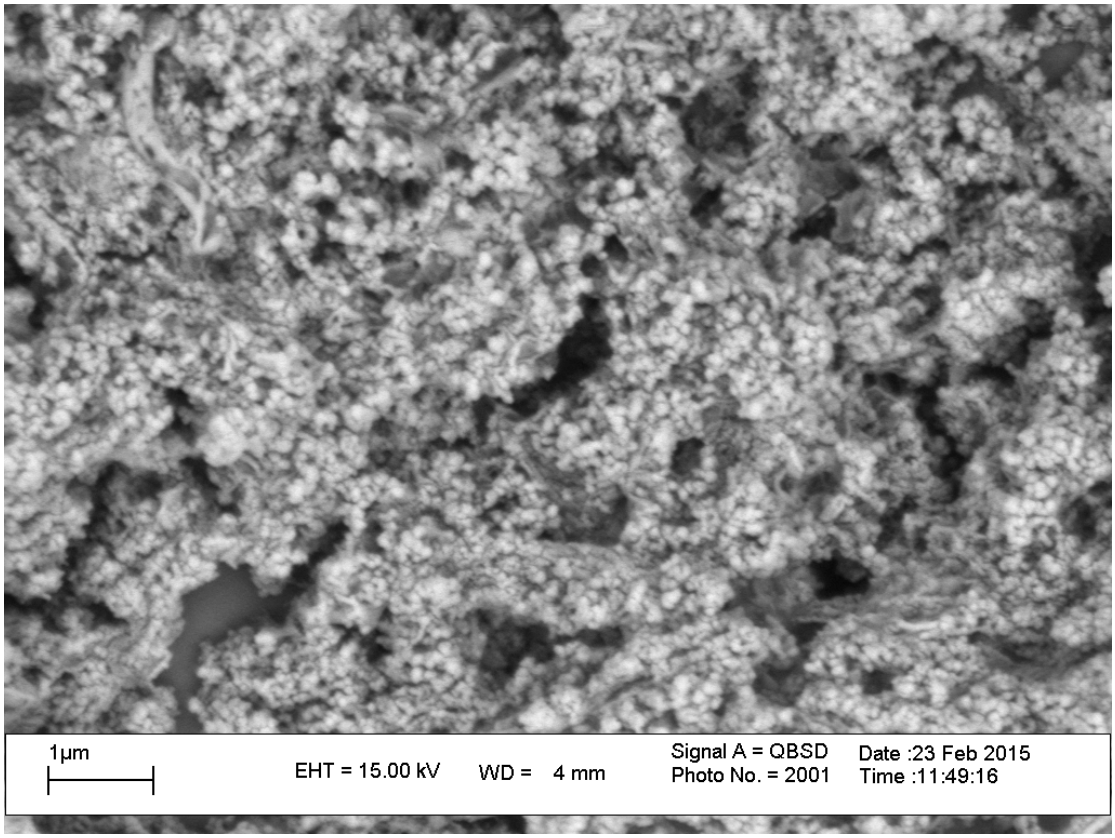



b

Fig. S5. SEM image from mixing **1** (2 mL, 4.21 mM ), benzyl alcohol (0.25 mL) and Oxone (1 mL, 81 mM) in water after 10 minutes (a,b). The centrifuged particles were washed carefully with solvent before considering by SEM.

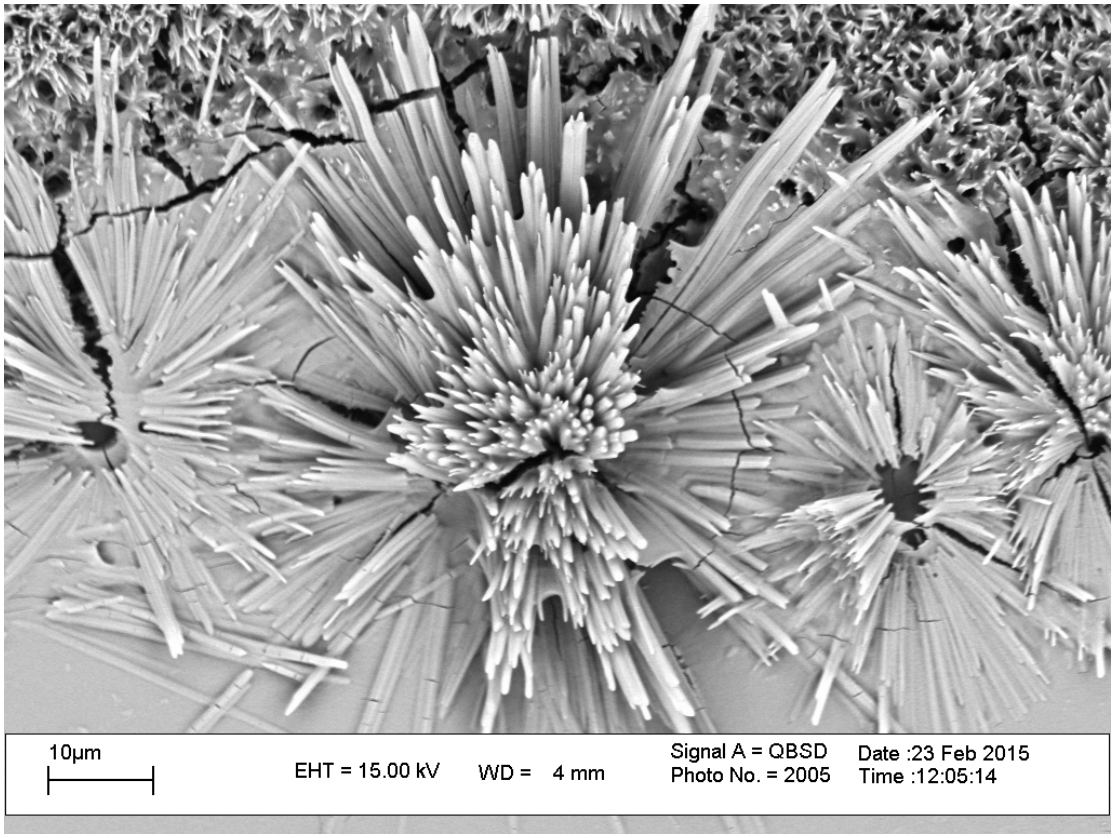



a

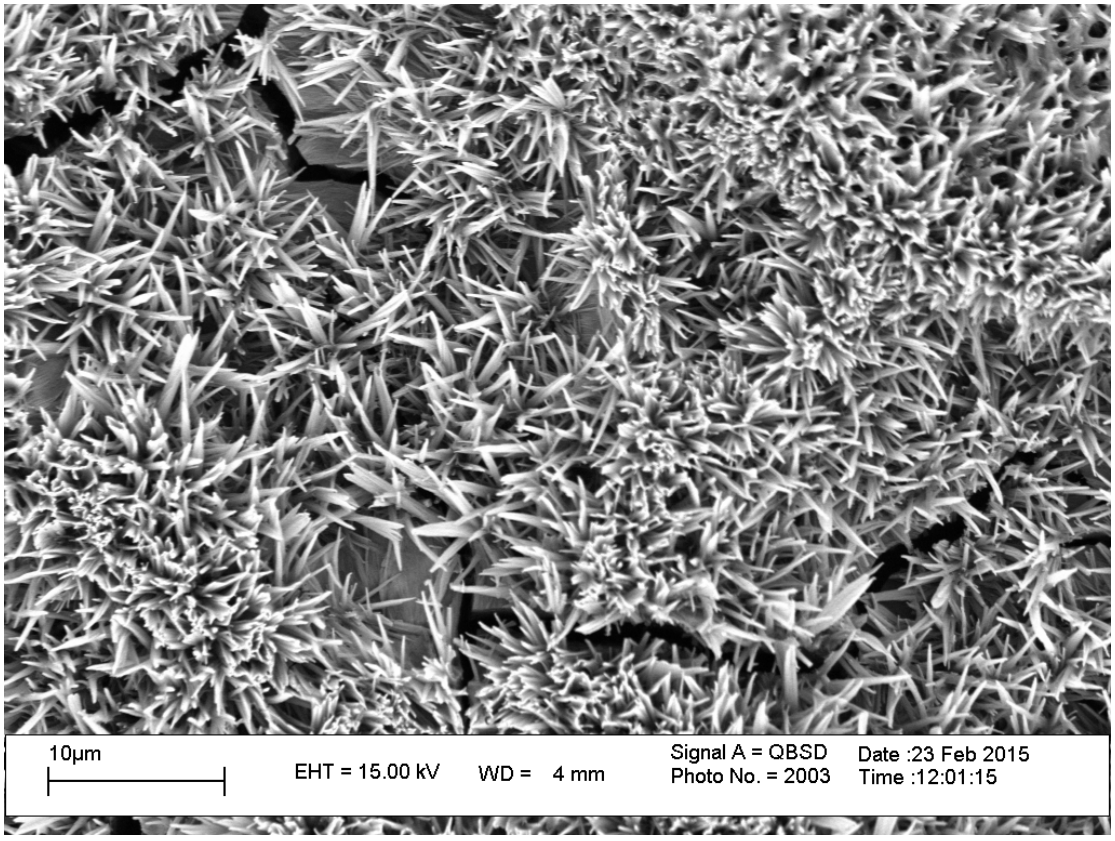



b

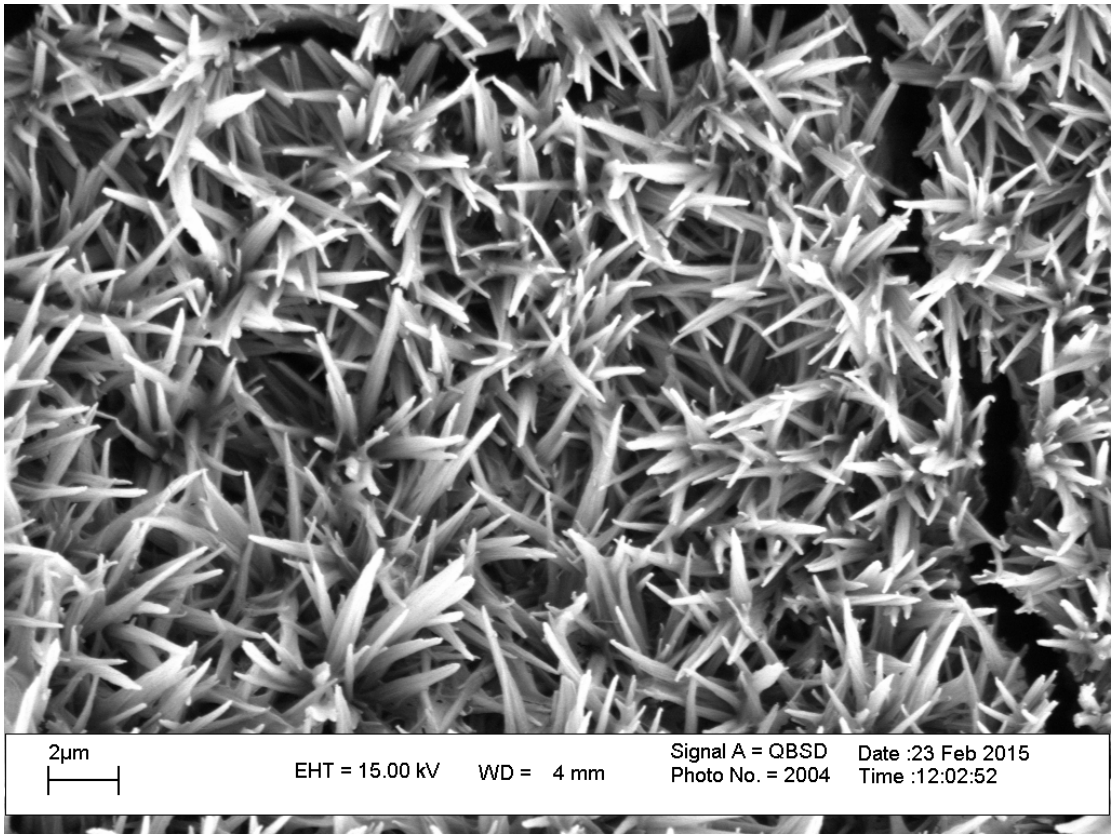
Fig. S6. SEM image from mixing **1** (4 mL, 4.21 mM ), benzyl alcohol (0.25 mL) and Oxone (0.5 mL, 81 mM) in water after 10 minutes.The centrifuged particles were washed carefully with solvent before considering by SEM (a,b).


10µm
EHT = 15.00 kV
WD = 4 mm
Signal A = QBSD
Photo No. = 2005
Date :23 Feb 2015
Time :12:05:14

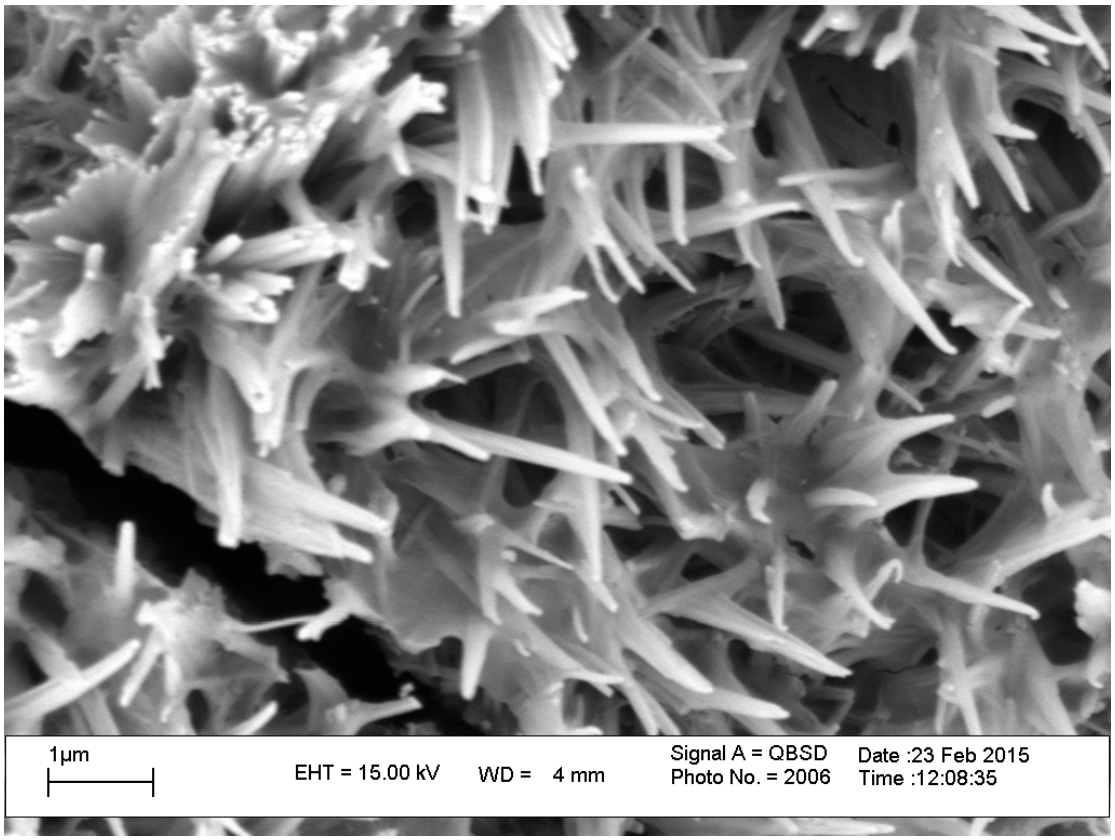
a


10µm
EHT = 15.00 kV
WD = 4 mm
Signal A = QBSD
Photo No. = 2003
Date :23 Feb 2015
Time :12:01:15

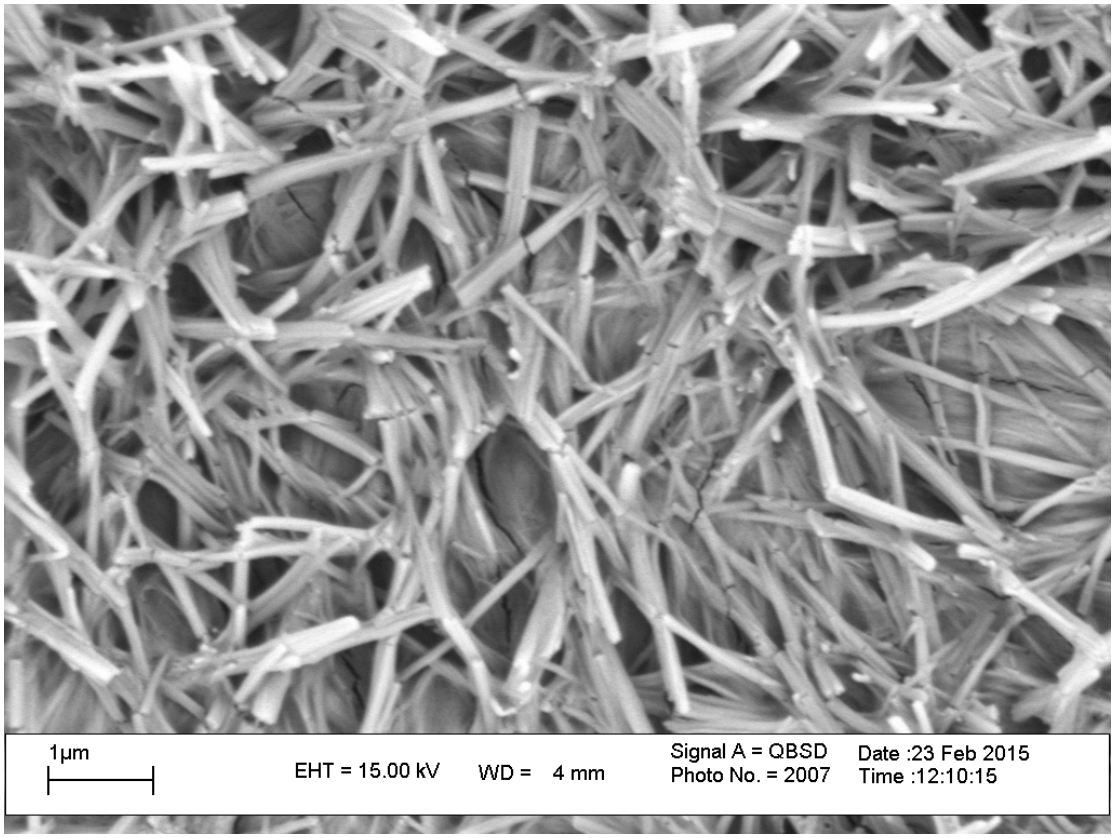
b


2µm
EHT = 15.00 kV
WD = 4 mm
Signal A = QBSD
Photo No. = 2004
Date :23 Feb 2015
Time :12:02:52

c


1µm
EHT = 15.00 kV
WD = 4 mm
Signal A = QBSD
Photo No. = 2006
Date :23 Feb 2015
Time :12:08:35

d




e

Fig. S7. SEM image from mixing **1** (4ml, 4.21 mM), benzyl alcohol (0.25 mL) and Oxone ® tetrabutylammonium (0.5 mL, 26 mM) in acetonitrile after 10 minutes. The centrifuged particles were washed carefully with solvent before considering by SEM.