Supporting Information

Green solvents ionic liquids: structural directing pioneers for microwave assisted synthesis of controlled MgO nanostructures

Arvind H. Jadhav, Alan C. Lim, Gaurav M. Thorat, Harsharaj S. Jadhav, and Jeong Gil Seo*

Department of Energy Science and Technology, Energy and Environment Fusion Technology Center, Myongji University, Myongji-ro 116, Cheoin-gu, Yongin-si, Gyeonggi-do 449-728, Republic of Korea

1. Preparation of designer solvents monocationic and dicationic ILs

1.1. 1-Methyl, 3-butylimidazolium Chloride[C_4(mIm)Cl]: (97.0 %) **(*IL-1*)** (M.P-54 ^oC) and 1-Methyl, 3-butylimidazolium bromide [C_4(mIm)Br] (97.0%) **(*IL-2*)** (M.P – 56 ^oC) were obtained highest purity from Sigma Aldrich (U.S.A).

*1.2. Preparation of Bis (3-methylimidazolium-yl) butane dichloride [$C_4(mIm)_2Cl_2$]**(IL-3)** :* A solution of *N*-methyl imidazole (2.0mmol) and 1, 4 dichloro butane (1.0mmol) in acetonitrile was refluxed magnetically for 48 h in a two necked round bottom flask equipped with water condenser. After completion of reaction, the reaction mixture was allowed to cool at room temperature. The solvent was evaporated under reduced pressure on rotary evaporator at 55 ^oC. The reaction mixture was washed three times with dry ethyl acetate to remove unreacted starting materials and resulting product bis (3-methylimidazolium-yl) butane dichloride [$C_4(mIm)_2Cl_2$] : Yield (86 %) white solid; (M.P-119 ^oC); ^1H NMR (400 MHz, $CDCl_3$): δ 9.19 (s, 2 × H), 7.81 (s, 2 × H), 7.73 (s, 2× H), 4.43 (t, 2 × 2H), 3.78 (s, 3 × 2H); ^{13}C NMR (400 MHz, $CDCl_3$): δ 144.22,

134.71, 132.41, 58.23, 41.65, 32.76. Elem. Anal. Calc. (%) for $C_{10}H_{20}Cl_2N_2$: C, 49.49; H, 6.92; N, 19.24; Found: C, 49.52; H, 6.94; N, 19.29.

1.3. bis (3-methylpyridinium-yl) butane dichloride [$C_4(mPyr)_2Cl_2$] For the preparation of ***(IL-4)*****,** fallowed the same reaction procedure as described in section 1.2, using 3-methyl pyridine (2.0mmol)and 1-chloro butane (1.0mmol). Yield 87%; white solid; (M.P- 162^oC); ^1H NMR (400MHz, $CDCl_3$): δ 8.96 (s, 2 × H), 8.94 (d, 2 × H), 8.73 (d, 2 × H), 8.21 (t, 2 × H), 4.78 (t, 2 × 2H), 2.42 (s, 2 × 3H), 1.32 (t, 2 × 2H), ^{13}C NMR (400MHz, $CDCl_3$): δ : 151.32, 146.51, 144.31, 139.89, 127.71, 73.16, 29.04, 17.13. Elem. Anal. Calc. (%) for $C_{16}H_{22}Cl_2N_2$: C, 61.34; H, 7.08; N, 8.94; Found: C, 61.38; H, 7.11; N, 8.99.

1.4. Preparation of Butyl, 3-methyl pyridinium chloride [$C_4(mPyr)Cl$] ***(IL-5)****:* For the preparation of IL-4**,** fallowed the same reaction procedure as described in section 2.3.2, using 3-methyl pyridine (1.0mmol) and 1-chloro butane (1.0 mmol). Yield 94 %; white solid; (M.P- 71 ^oC); ^1H NMR (400 MHz, $CDCl_3$): δ 9.09 (d, H), 8.94 (s, H), 8.73 (s, H), 8.21 (t, H), 4.71 (t, 2H), 2.52 (s, 3H), 1.34 (m, 2H), 1.31 (m, 2H); 0.97 (t, 3H) ^{13}C NMR (400 MHz, $CDCl_3$): δ : 149.22, 144.81, 143.14, 139.08, 128.71, 72.56, 32.76, 22.04, 18.19,13.72. Elem. Anal. Calc. (%) for $C_{10}H_{16}ClN$: C, 64.68; H, 8.68; N, 7.54; Found: C, 64.71; H, 8.65; N, 7.58.

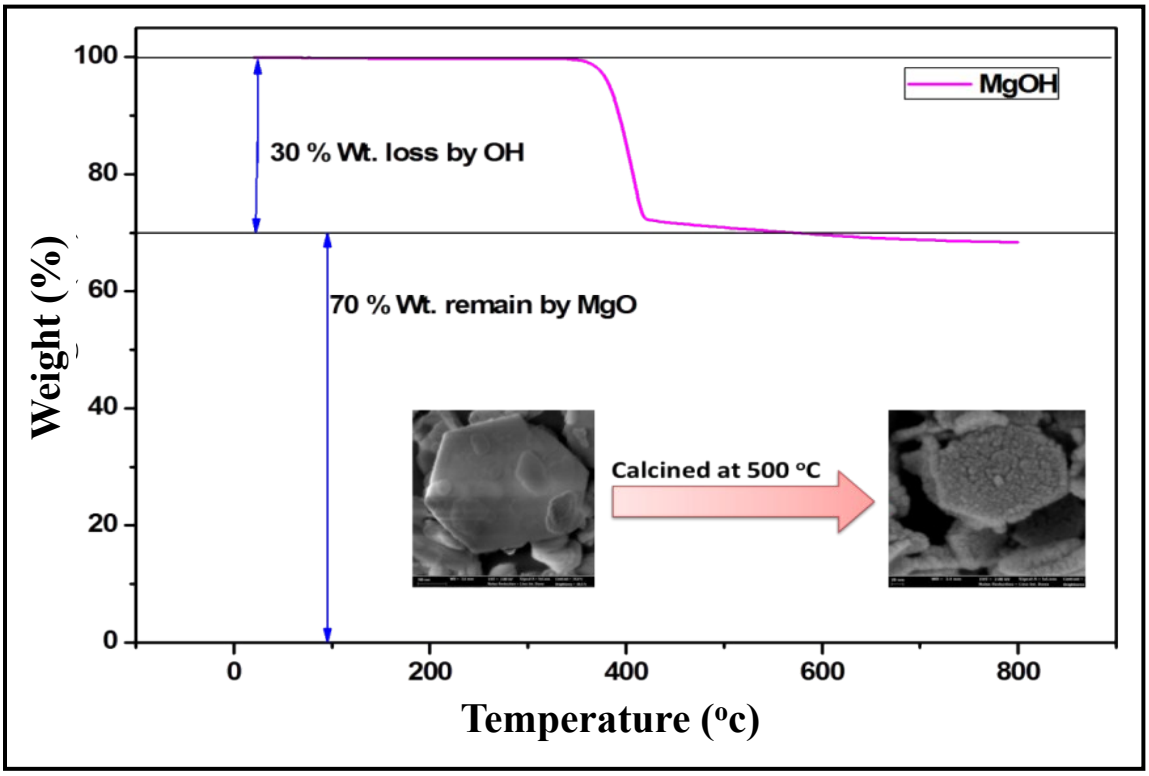

Fig. S-1 - TGA analysis of synthesized Mg(OH) in $[C_4(mIm)_2Cl_2]$.

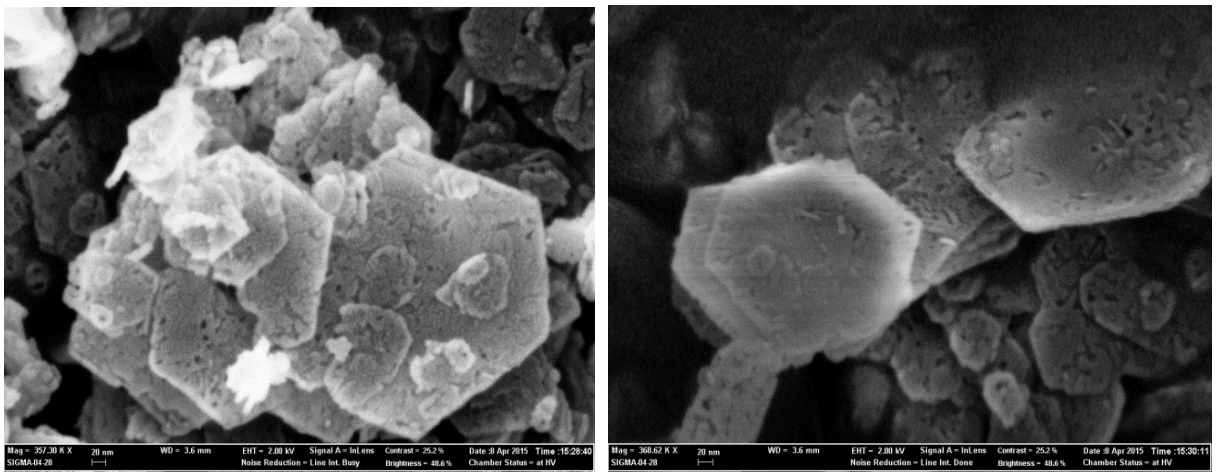

Fig. S-2. Nanohexagons obtained in dicationic IL $[C_4(mIm)_2Cl_2]$ (IL-3) from increased heating cycles from 10-11 times repeatedly giving break of 1-2 min of 400 power radiation of MW.

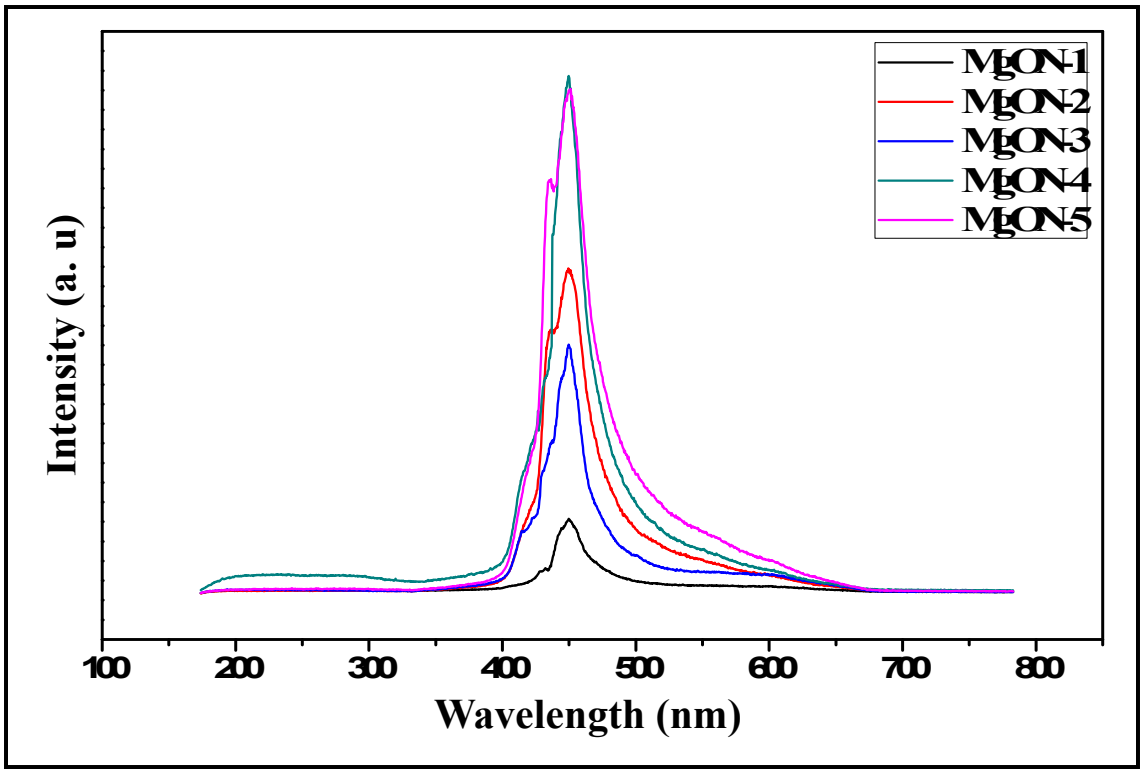

Fig. S-3 - Photoluminescence spectra at room temperature of different MgO nanostructures.

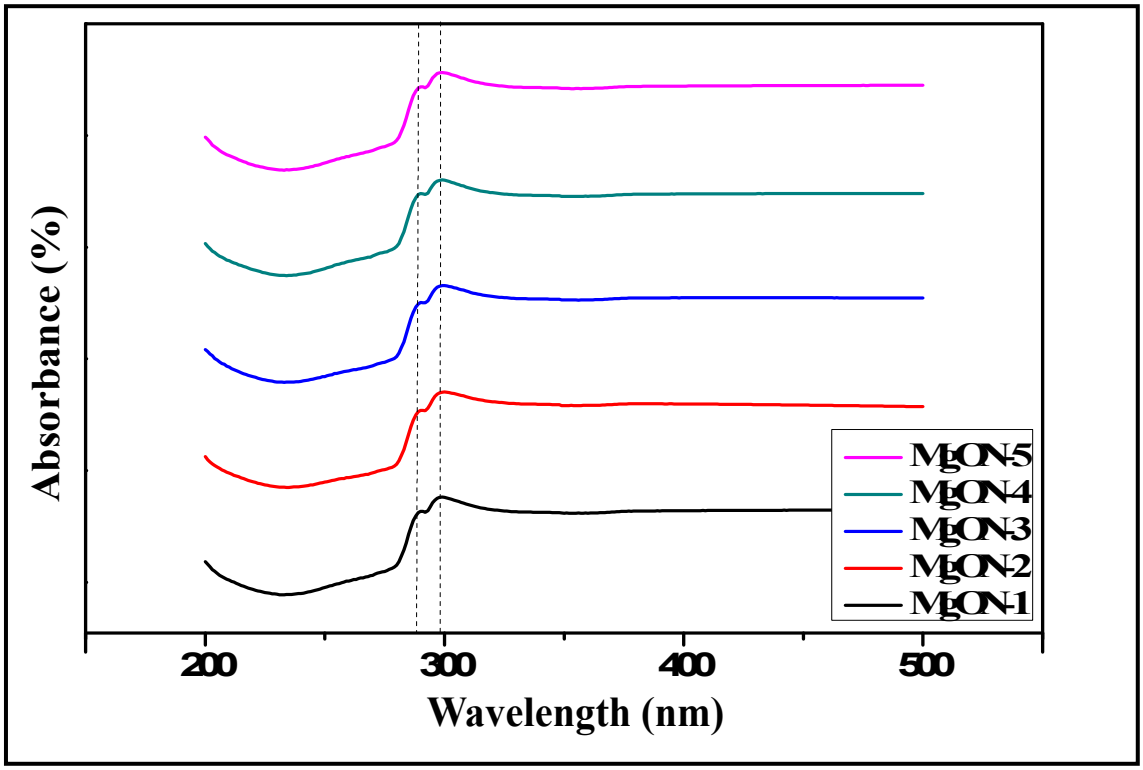

Fig. S-4 – UV-Vis analysis of morphologically controlled MgO nanostructures.

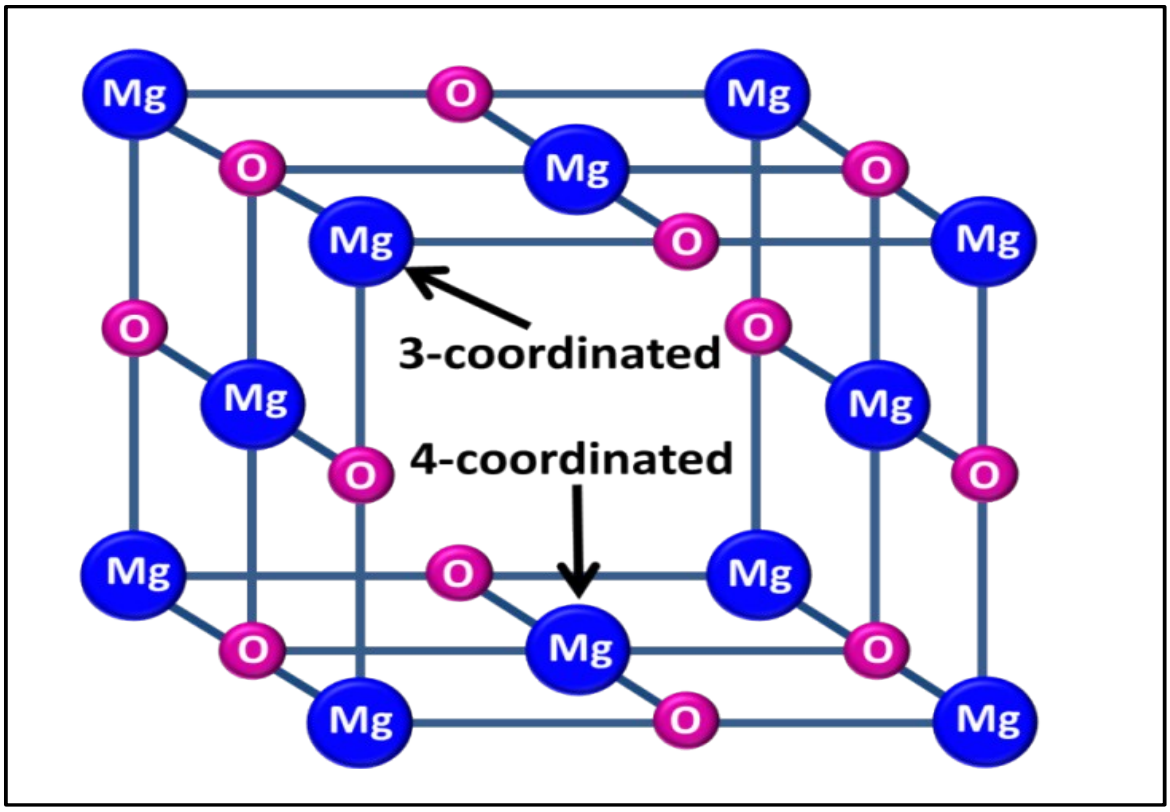

Fig. S-5 - Schematic crystal structure representation of MgO.

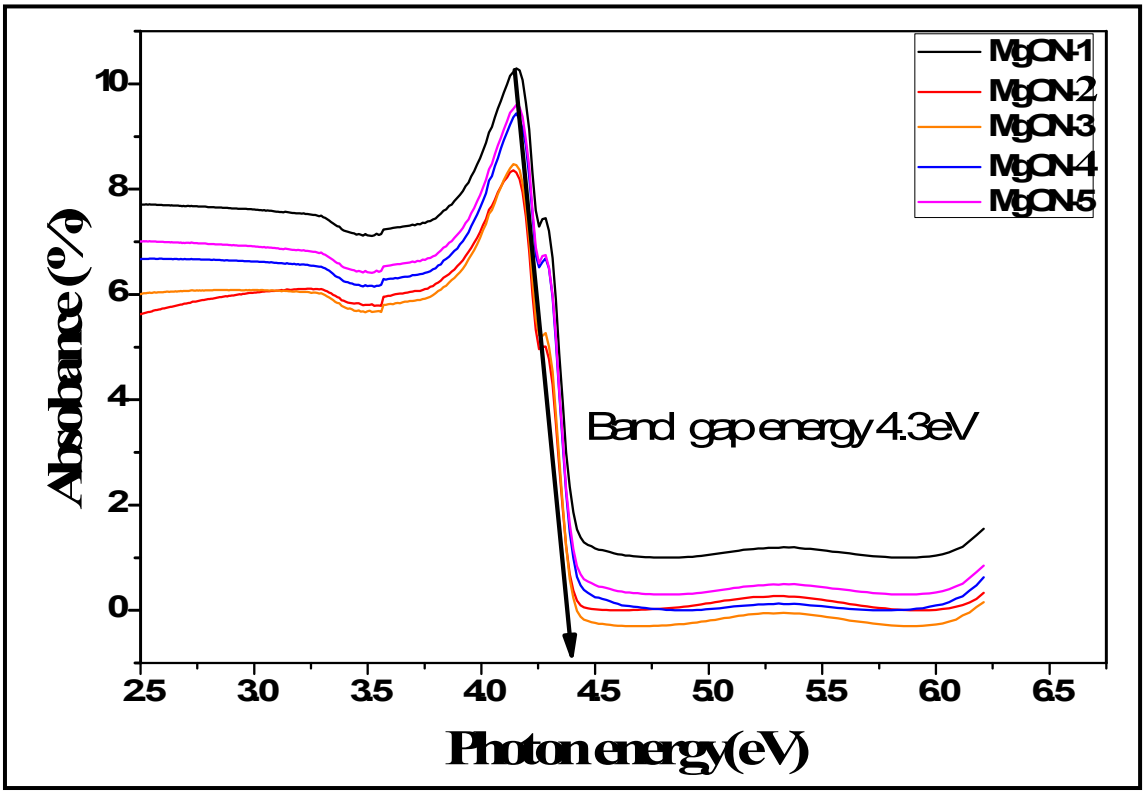

Fig. S-6 - Band gap determination of morphologically controlled MgO nanostructures.

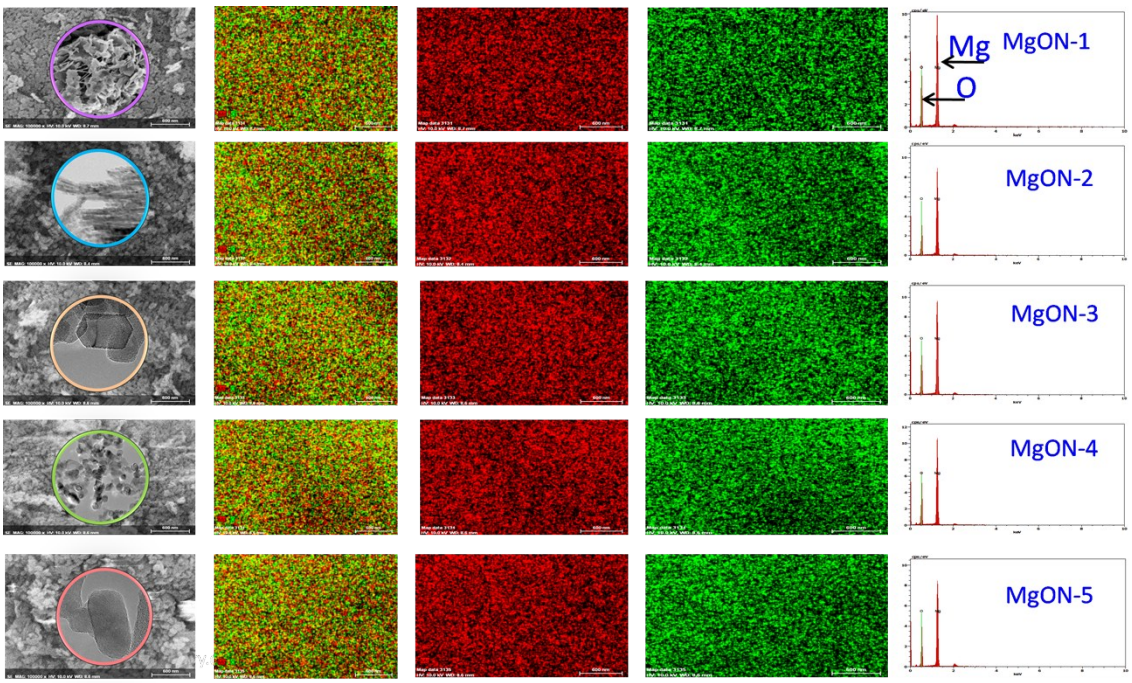

Fig. S-7 – EDS spectrum and EDS mapping of various MgO nanostructures.