Appendix-1: Instrumental details

Confocal microscope:

An LSM 710 Carl Zeiss Laser Scanning Confocal Microscope (LSCM) was used to image the fluorescent samples. He-Ne laser (543 nm) and Argon-ion laser (488 nm and 514 nm) was used for our experiments.

FTIR spectrophotometer:

FT-IR spectra were recorded on Perkin Elmer FT-IR spectrum GX instrument by making KBr pellets in diffuse reflectance mode, operating at a resolution of 4 cm\(^{-1}\). Pellets were prepared by mixing 3 mg of sample with 97 mg of KBr.

High resolution transmission electron microscope:

HR-TEM images were taken on a FEI Technai F30 operating at 300 kV. The samples were prepared by dispersing a 0.1 mg/mL of nanoparticles by sonication, and drop casting the resulting suspension on a carbon coated copper grid of 400 mesh and allowed to dry in air. The TEM of scaffold samples was prepared by embedding the scaffold in the epoxy resin and microtome to view the sample under HRTEM.

Inductive coupled plasma instrument:

ICP experiments were performed on a Thermo IRIS Intrepid spectrum apparatus. The typical procedure used is as follows: The calculated amount of sample was dried in vacuo overnight was taken into a beaker and heated with aqua-regia for 20 mins. It was then filtered and diluted with aqua-regia into a 25 ml volumetric flask using. This stock solution was then diluted using milipore water and was analyzed by using the ICP instrument for quantitative determination of Au.

Optical Microscope:

Optical microscopy was performed using an Olympus-BX 50 equipped with a crossed polarizer setup and images were obtained using a Lookman CCTV camera. The samples were prepared by sandwiching dispersed samples between the glass slide and cover slip.

Thermogravimetric Analyser:

Thermo gravimetric analysis (TGA) of the silica nanoparticles were carried out using a TA Instrument SDT Q600 analyzer between 20 and 800 °C in air (flow 50 ml min\(^{-1}\)) at a heating rate of 10 °C min\(^{-1}\). All samples were dried under vacuum at 60 °C overnight prior to TGA runs. The graft density of the grafted moiety on the silica
Ph.D Thesis  

**Appendix I**  

**Instrumental details**

Surface area was determined by thermo gravimetric analysis (TGA) using following equation as described before.

Graft density ($\mu$mol/m$^2$) =

$$
\frac{W_{\text{GraftedSilica}(150-700)}}{100-W_{\text{GraftedSilica}(150-700)}} \times 100 - W_{\text{Silica}(150-700)} \times 10^6
$$

Where $W_{150-700}$ is the weight loss between 150 and 700 °C corresponding to the decomposition of the grafted silica molecule corrected from the thermal degradation and $M$ is the molecular weight of the grafted silane. $S$ represents the specific surface area of the silica nanoparticle (measured as 110 m$^2$/g) while $W_{\text{Silica}}$ represents the determined weight loss of silica before grafting.

**Scanning Electron microscope:**

Samples were imaged using a Quanta 200 3D scanning electron microscope (SEM). Samples were placed on carbon tape which was gummed on a sample holder.

**Solid State NMR:**

$^{29}$Si and $^{13}$C Cross Polarization Magic Angle Spinning (CPMAS) NMR experiments were carried out on a Bruker AVANCE 300 wide bore spectrometer equipped with a superconducting magnet with a field of 7.1Tesla. The operating frequencies for $^{13}$C and $^{29}$Si were 300MHz, 75.4MHz and 59.6MHz respectively. The samples were packed into a 4mm zirconia rotor and loaded into a 4mm BL MAS probe and spun about the magic angle (54.74) at 10KHz using a standard ramp-CP pulse sequence was used for both the experiments. The RF-powers were 50kHz and 60kHz for the $^{29}$Si and $^{13}$C CPMAS experiments. The contact times were 6ms and 3ms for the $^{29}$Si and the $^{13}$C CPMAS experiments. All the chemical shifts were referenced to TMS. Typically 10,000 to 25,000 scans with a recycle delay of 3s were collected depending on the sensitivity of the sample.

**Surface area measurement instrument:**

Nitrogen adsorption and desorption studies were carried out using Quadrasorb SI instrument. Before the nitrogen adsorption measurement, the samples were degassed overnight under vacuum using FloVac Degasser at 300 °C (for silica) or at
100 °C (for modified silicas). Multi point BET surface area was obtained from adsorption isotherm from $P/P_0$ 0.01-0.1. Pore size distributions were calculated from adsorption isotherm using the BJH method.

**UV-visible spectrophotometry:**

The catalytic reaction was monitored by UV-vis spectra on a Cary 300 Conc UV-Visible spectrophotometer operated at a resolution of 2 nm.

**X-ray diffraction:**

Powder X-ray diffraction of all the mesoporous samples was carried out in a PANalytical X’pert Pro dual goniometer diffractometer. A proportional counter detector was used for low angle experiments and an X’celerator solid state detector was employed in the low angle experiments. The radiation used was Cu K$_\alpha$ (1.5418 Å) with a Ni filter and the data collection was carried out using a flat holder in Bragg–Brentano geometry (0.5 to 10°; 0.2° min$^{-1}$). Care was taken to avoid sample displacement effects.

Solid dried core-shell nanoparticle samples were coated on glass slides and characterized with powder X-ray diffraction (Xpert Pro, Panalytical, Cu K$_\alpha$) in the 20 range of 30-80 degree which was operated at 40 kV and 30 mA.

**X-ray photoelectron spectroscopy**

XPS measurements of the samples were deposited on sample holder and were carried out on a VG MicroTech ESCA 3000 instrument at a pressure of better than $10^{-9}$ Torr. The general scan and Si 2p, C 1s, N 1s, O 1s, Cl 2p and Au 4f core level spectra were recorded with unmonochromatized Mg-K$_\alpha$ radiation (photon energy ~ 1253.6 eV) at pass energy of 50 eV and electron take off angle (angle between electron emission direction and surface plane) of 60°. The overall resolution of measurement is thus 1 eV for the XPS measurements. The core level spectra were background corrected using the Shirley algorithm. The core level binding energies (BE) were aligned with the silica binding energy of 103.4 eV.
Appendix-2: NMR details

$^1$H NMR (500 MHz, CDCl$_3$) and $^{13}$C NMR (50 MHz, CDCl$_3$) of compound of 3-azidopropyltriethoxysilane

NMR details
$^1$H NMR (200.13 MHz, CDCl$_3$) and $^{13}$C NMR (50.32 MHz, CDCl$_3$) of compound of prop-2-ynyl 3-(prop-2-ynyloxy)picolinate
\(^1\)H NMR (200.13 MHz, CDCl\(_3\)) and \(^{13}\)C NMR (50.32 MHz, CDCl\(_3\)) of compound prop-2-ynyl 3-(prop-2-ynyloxy)picolinic acid
$^1$H NMR (500.13 MHz, CDCl$_3$) and $^{13}$C NMR (125.76 MHz, CDCl$_3$) of compound prop-2-ynyl 2-(prop-2-ynyloxy)benzoate
$^1$H NMR (200.13 MHz, CDCl$_3$) and $^{13}$C NMR (50.32 MHz, CDCl$_3$) of compound prop-2-ynyl 2-(prop-2ynyloxy)benzoic acid
\(^1\)H NMR (400.13 MHz, CDCl\(_3\)) and \(^{13}\)C NMR (50.32 MHz, CDCl\(_3\)) of compound 4-methyl-1, 3-dihydroisobenzofuran-5-ol
$^1$H NMR (200.13MHz, CDCl$_3$) and $^{13}$C NMR (100.61MHz, CDCl$_3$) of compound 5-methyl-2-tosylisoindolin-4-ol
$^1$H NMR (400.13MHz, CDCl$_3$) and $^{13}$C NMR (100.61MHz, CDCl$_3$) of compound dihydroisobenzofuran-4-ol
$^1$H NMR (200.13MHz, CDCl$_3$) and $^{13}$C NMR (50.32MHz, CDCl$_3$) of compound 1,3-dihydroisobenzofuran-5-ol
$^1$H NMR (200.13 MHz, CDCl$_3$) and $^{13}$C NMR (100.61 MHz, CDCl$_3$) of compound 2-tosylisoindolin-4-ol
$^1$H NMR (200.13MHz, CDCl$_3$) and $^{13}$C NMR (50.32MHz, CDCl$_3$) of compound 2-tosylisoindolin-5-ol