Supporting Information

Dielectric Properties

The dielectric constant and loss factor for the materials used in this study are shown in **Fig. 1** and **Fig 2** respectively.

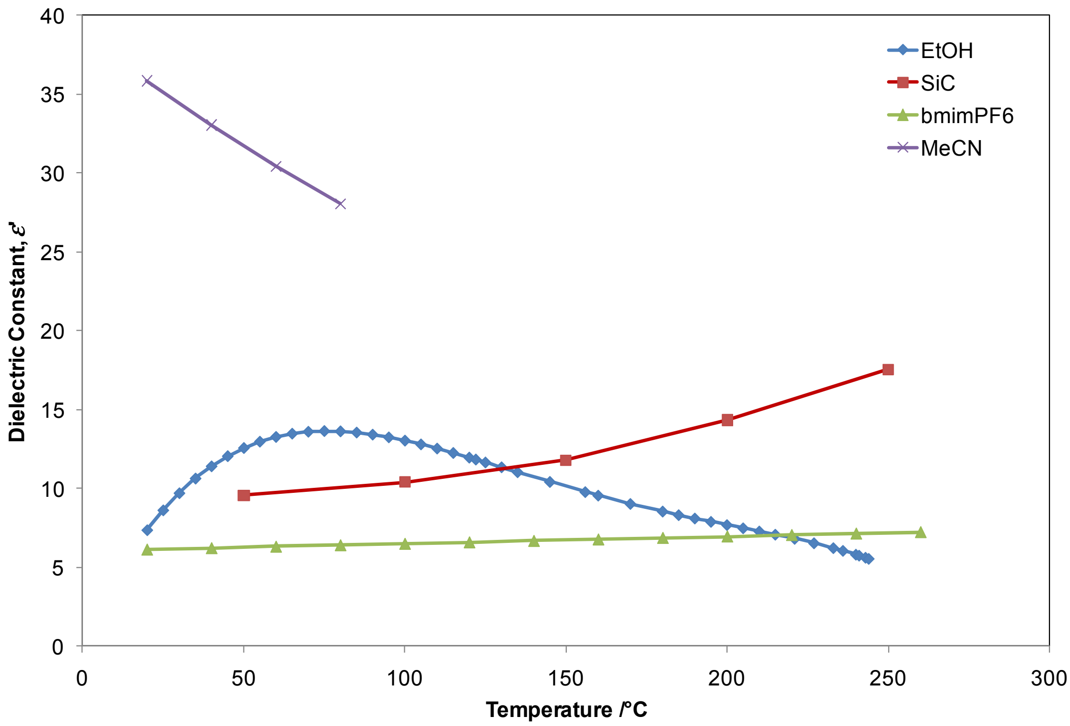

Fig. 1. Dielectric Constant of SiC and solvents at 2.45 GHz and 20 - 250°C.

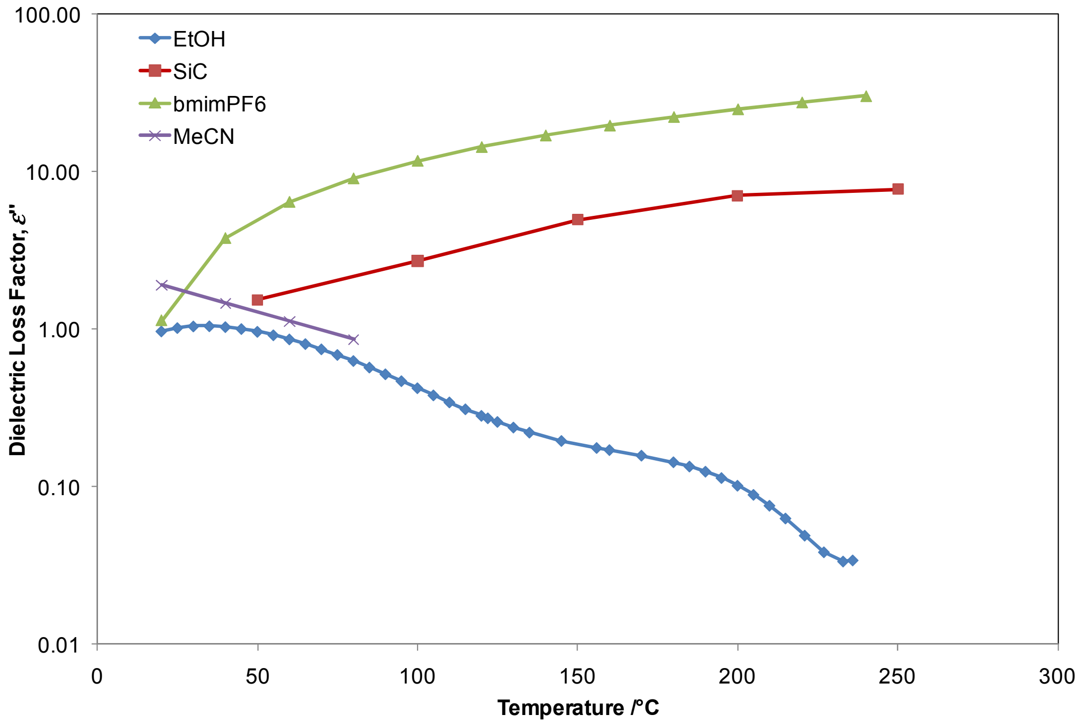

Fig 2. Dielectric loss factor for SiC and solvents at 2.45 GHz and 20 - 250°C.

Simulations and models

Electromagnetic simulations were performed using COMSOL multiphysics software, which uses the finite element method to resolve the electric field distribution, power dissipated and temperature profiles based on the dielectric properties of the system. Accurate dimensional measurements were made of the internals of the CEM Discover LabMate system, along with measurements of the reaction vessels, stirrer bar, fibre optic sensor and sapphire sleeve along with their respective positions within the cavity. The liquid level was also measured for the different volumes studied. A framework was constructed within COMSOL containing the CEM Discover and its internals, which is shown in **Fig 14**.

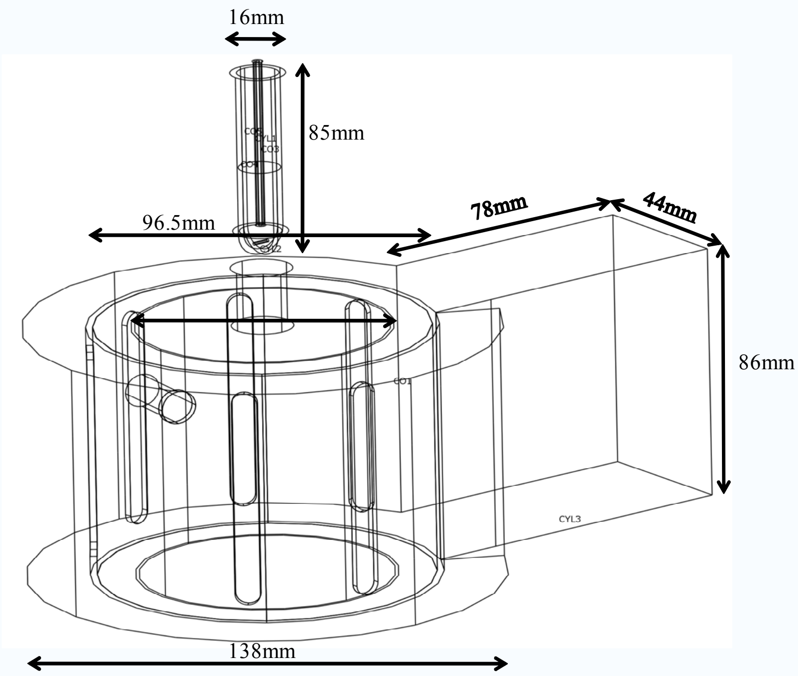

Fig. 14. Schematic of CEM Discover LabMate system

The 3D electric field distribution was calculated based on the dielectric properties and spatial parameters. The power density in each individual element of the mesh was then calculated from the electric field strength and the dielectric loss factor of the material, and the temperature rise calculated from the energy dissipated over time and the heat capacity of the materials in the cavity.

It is not possible to directly simulate the spinning magnetic stirrer using COMSOL. The stirring action was taken into account by setting the thermal conductivity of the liquid to be very high, essentially producing a condition of perfect mixing within the tube. For liquid volumes of 1-5 mL and stirring rates ~300 rpm the liquid is likely to be very well mixed.