Invited Lecture
Inter-Disciplinary Explorations in Chemistry (I-DEC 2018)

Role of novel materials in the future energy mix

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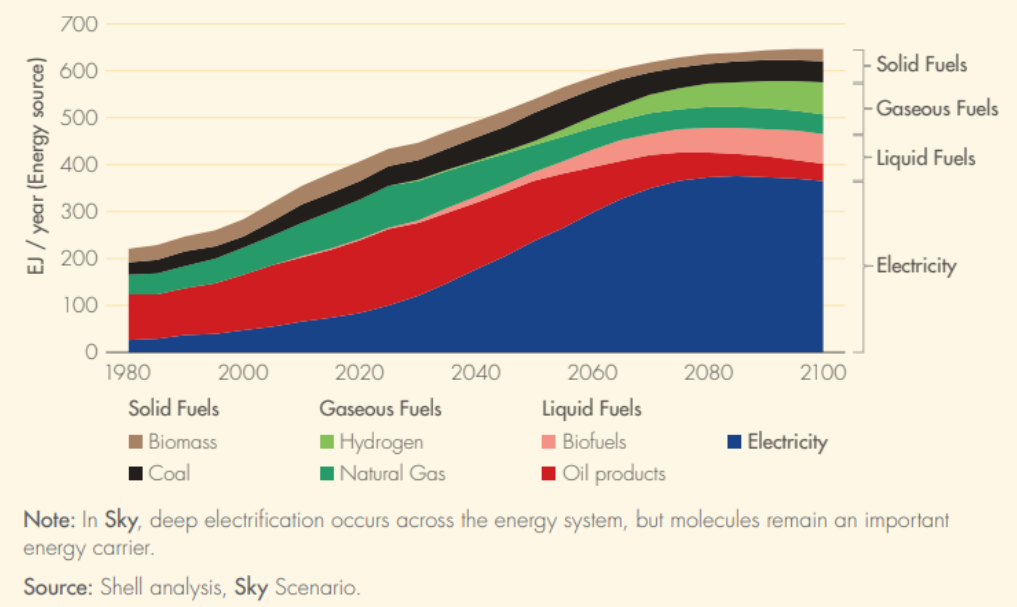
Abstract:
In the coming decades, the global energy mix will undergo a transition where majority of energy demand will be fulfilled by renewable energy sources in all parts of the world (see figure below[1]). This development is driven by ongoing reductions in costs of solar and wind energy combined by the necessity to reduce CO_2 emissions in line with Paris agreement[2]. Therefore, it is expected that 'renewable electrons' will become available at very competitive prices in the second half of the 21st century. With this energy transition in mind, Shell has recently increased its R&D efforts in partnership with academic groups across the world across three main domains. R&D is spread across: (i) advanced energy storage; (ii) dense energy carriers; (iii) valorisation of natural gas.

In this talk, a brief overview of ongoing R&D efforts in these domains will be shared followed by a few examples emphasizing the role of novel materials to tackle some of these technological challenges.

Figure: Global End Energy-use consumption[1]



References and Notes:

1. https://www.shell.com/energy-and-innovation/the-energy-future/scenarios/shell-scenario-sky.html
2. https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement

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Bio-Sketch of Speaker

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Dr. Agrawal received his Mechanical Engineering degree from Indian Institute of Technology, Kanpur in 2002. From 2002 to 2004, he was affiliated with GE Aviation optimizing designs of rotor stages of compressors and turbines used in jet engines using finite element-based approaches. In fall of 2004, he joined Northwestern University to pursue his doctoral studies in Mechanical engineering primarily focusing on nanomaterials. His doctoral work involved various projects: (i) characterization of Atomic Force Microscopy (AFM) probes made of nanocrystalline diamond for their wear performance; (ii) molecular modelling of metallic & semiconducting nanowires to elucidate size effects on mechanical and piezoelectric properties; (iii) application of local electrode atom probe (LEAP) tomography techniques applied to GaN nanowires to quantify dopant distribution in individual nanowires.

In 2010, he joined GE Global Research in Bangalore where his work involved qualifying lubricant additives and coatings for application in wind turbine gear boxes. In 2012, he moved to Shell where he has primarily been working in the domain of heterogenous catalysis and application of novel materials for green-house gas (GHGs) reduction. He has published ~13 articles in peer-reviewed journals and 20+ internal corporate reports on various topic. Outside of work, he is a long-distance runner and an avid volleyball player.