

*Keynote*

## **OXIDATION OF SOLID CARBON: WHAT WE KNOW AND WHAT WE NEED TO KNOW**

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Oxidation of solid carbon is probably the reaction that mankind exploited first, since the very discovery of fire. Over the ages combustion of wood first and of fossil fuels later, has in fact sustained the energy demand and the progress of human society and, despite the efforts of the scientific community to find alternative routes for energy production, a significant fraction of the global energy demand is likely to remain dependent on combustion of solid carbon also in the near future.

In the second half of the last century the need to reduce pollution from coal fired power plants motivated significant research on the chemistry as well as on the physical phenomena involved in coal combustion. This allowed important scientific and technological advances in the field. A turning point in the technology of coal combustion was the advent of low NO<sub>x</sub> burners. The low NO<sub>x</sub> generation boilers, while contributing significantly to solve the problem of NO<sub>x</sub> emissions, posed new and unexpected issues, such as near extinction problems and loss of combustion efficiency, which gave new impulse to fundamental research on coal combustion.

In more recent times the driving force for research on coal and solid carbon combustion has become the need to reduce CO<sub>2</sub> emissions into the atmosphere, enhancing the use of biomass and looking for new and economically viable clean coal technologies. Again researchers have been called to answer new questions. Among them the effects of co-combustion of different fuels and the effects that oxyfuel conditions have on coal combustion.

On a parallel route the current rush towards the development of innovative carbon based materials (such as graphene and carbon composites) for a multitude of industrial applications, discloses unresolved questions on the chemistry and physics of solid carbon and in particular on the complexity of the chemical interactions between solid carbon and oxygen in a wide range of operating conditions.

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