Materiali funzionali e prototipi

Functional materials and prototypes

DII research group

PEG: Polymer Engineering Group

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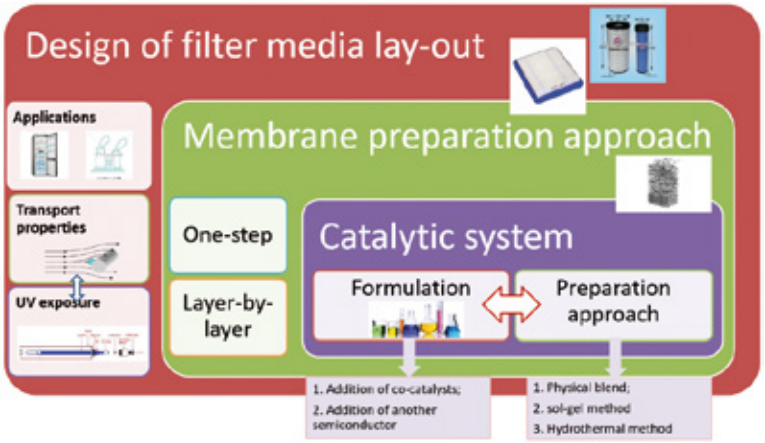
The research activity is carried out in collaboration with: Prof. M. Modesti and Prof. A. Lorenzetti at the Polymer Engineering Group

Main research topics:

- Nanostructured Media:
  Air purification: PCO processes for VOCs abatement; Technologies and Implemented strategies for enhancing the photocatalytic performance; CO2 capture;
- DoE (RSM, Process optimization)
- Functional materials (Magnesium borate, Silicon oxycarbide ceramics…)
- Electrospun scaffolds for biomedical applications
- High performance nanocomposites (both thermoplastic and thermoset)
- Polymers fire behaviour and thermal resistance

Strategies for enhancing the performance of TiO_2 based nanostructured membranes for VOCs abatement

Investigation of indoor and outdoor air quality has become, in the last decade, an important scientific concern. Volatile Organic Compounds (VOCs) represent an heterogeneous group of organic chemicals strongly present in those industrial activities related to the use of solvents, such as printing, spray painting, coil coating, wood treatment etc. Due to the pressing need for actions to improve air quality and protect people and ecosystems from the threats posed by air pollution, scientists spend a lot of efforts trying to investigate the health effects of pollutants, as well as the potential strategies for their control and abatement.



Since the beginning of this research work, we dealt with photo-oxidation of methanol in gas phase, studying different nonwoven mats assemblies6, and eventually the effect of a co-catalyst, based alternatively on Graphene oxide (GO), reduced graphene oxide (rGO) and graphene (G). What appears clear is how different intervention strategies can exist in the case of photocatalytic processes carried out by electrospun nanostructured materials. First, it is possible to act on the catalytic system in terms of formulation (addition of a co-catalyst or addition of another semiconductor) and preparation approach (physical blend, sol-gel method, hydrothermal method). Subsequently, it is possible to deal with the membrane preparation approach and finally with the design of the active filter media lay-out, including the UV exposure and the transport properties of the mixture to be treated. According to this, the principal goal of the research is the design an active filter media with sufficient photocatalytic activity and adequate physicochemical stability. The results obtained varying the formulation of the photo-catalytic systems are reported here with respect to photo-oxidation in gas-phase of 1600ppm of acetaldehyde.

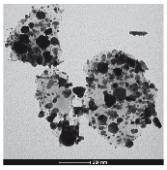
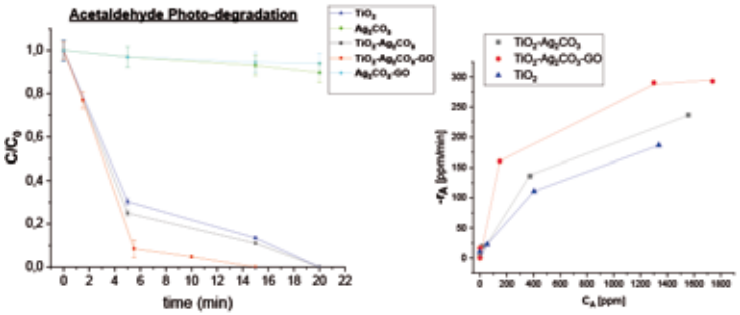


Figure. Acetaldehyde removal vs time (a) and reaction rate vs concentration (b) for all the photocatalytic systems.



(a) (b)