Editorial corner – a personal view

Carbon dioxide ‘management’ by polymers

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Carbon dioxide (CO₂) is the major ‘greenhouse’ gas, responsible for global climate warming. Unfortunately, its emission will further increase in the following two decades which fuels the already existing public concerns. Major sources of the CO₂ emissions are the biomass and among the anthropogenic ones, the power plants fired by fossil fuels. Therefore the sequestration (ab- and adsorption processes to produce CO₂ in high purity) and utilization of CO₂ are actual and challenging tasks of great importance.

As capturing media of the chemical absorption/regeneration processes of the flue gases other polymer-based ab- and adsorption materials (liquid-like materials containing polyetheramine-grafted nanoparticles, polymeric ionic liquids, (micro)porous organic polymers (DOI: [10.1002/pi.4407](https://doi.org/10.1002/pi.4407)), solid microporous carbons from polymer-containing precursors) than the present amine-based solvents, are explored. They offer lower vapor pressure, less corrosiveness, improved chemical stability and easy regeneration compared to the state-of-art monoethanolamine. Polymer-based membranes with high selectivity are other tools for efficient CO₂ separation.

However, CO₂ may be a valuable chemical feedstock, especially for polymer synthesis. Owing to its chemical inertness, it has to be combined with highly reactive reagents under proper conditions. The pioneering work in this field has to be credited to Inoue et al (1969) who produced poly (propylene carbonate) (PPC) using CO₂ and propylene oxide. PPC is biocompatible and biodegradable, and today already commercially available. Its properties resemble to those of low density polyethylene and plasticized

polyvinyl chloride. To synthesize really alternating PPC copolymers with high molecular mass, and to improve their resistance to thermal degradation are, however, still open issues. That is the reason why ongoing research efforts are dedicated to the synthesis of various CO₂ containing co- and terpolymers, which are aliphatic polycarbonates. As comonomers, cyclohexene oxide, oxetane, ε-caprolactone, epichlorohydrin, glycidyl ether derivatives have already been tried (DOI: [10.1021/ma3019574](https://doi.org/10.1021/ma3019574) and [10.1021/ma400090m](https://doi.org/10.1021/ma400090m)). It is worth of mentioning that inorganic polymers are also involved in the CO₂ ‘immobilization’: Just one example is the hardening/silicification process of water glass (DOI: [10.1016/j.eurpolymj.2007.01.010](https://doi.org/10.1016/j.eurpolymj.2007.01.010)), widely used in building and construction.

There are a lot of opportunities to contribute to the sequestration and utilization of CO₂. In the case of the latter the most straightforward is to focus on polymer synthesis (polycarbonates, polyurethanes, polyureas) and modification of the resulting polymers to meet the requested performance. This may result in valuable contributions to the fight against global warming and to the reduction of mankind’s ‘carbon footprint’ – so, why not to make your own homework?

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