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Co-crystalline and Nanoporous-Crystalline Polymers

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ABSTRACT:
Crystallization is very relevant phenomenon for physical properties and applications of polymers. For instance, industrially relevant films and fibers are obtained only by semicrystalline polymers [1] as well as physically crosslinked polymer gels or aerogels are formed due to the presence of polymer crystalline phases, acting as crosslinking knots [2].

Nanoporous-crystalline (NC) polymer phases have been described starting from 1997, due to their relevance in molecular transport phenomena [3]. In fact, NC phases markedly increase, rather than decrease (as generally occurs for crystalline phases), the molecular uptake and diffusivity of polymers [3]. NC phases are commonly formed from co-crystalline (CC) phases by suitable guest extraction procedures, which leave nearly unaltered the polymeric host framework.

Usually the removal of low-molecular-mass guest molecules from co-crystalline (CC) phases generates amorphous or dense crystalline phases with the only exception represented by two relevant commercial available polymers: syndiotactic polystyrene (s-PS) and poly(2,6-dimethyl-1,4-phenylene)oxide (PPO) [3].

Polymeric NC phases, due to their high gas and vapor solubility even at low activity, are proposed for several applications, in air and water purification, catalysis, sensors as well as in food packaging [4].

Polymeric CC phases with active guest molecules can be easily achieved by guest sorption in sPS and PPO NC phases and they show relevant properties (antimicrobial, fluorescent, magnetic, ferroelectric, photo-reactive or chiral-optical), which could be useful for many applications [5].

In this communication, recent results on NC and related CC phases of sPS and PPO samples, will be presented.

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KEY WORDS: nanoporous-crystalline (NC) phases, co-crystalline (CC) phases, poly(2,6-dimethyl-1,4-phenylene)oxide (PPO)

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