

THERMAL CONDUCTIVITY OF POLYISOCYANURATE FOAMS (PIR) PRODUCED USING HYDROFLUOROOLEFINS (HFOs) AS BLOWING AGENTS

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Today, rigid foams based on polyurethanes are a fundamental part of our lives, as they are used in a wide range of applications. Inside this group of materials polyisocyanurate foams (PIR) are considered an improved solution, due to its resistance to fire and high temperatures. The raw materials and formulations used are similar to those used in the production of polyurethane, except that the proportion of isocyanate (MDI) is higher and the polyol used is a polyester.

Hydrofluoroolefins (HFOs) are unsaturated organic compounds comprising of hydrogen, fluorine and carbon. Unlike traditional hydrofluorocarbons (HFCs) and chlorofluorocarbons (CFCs), which are saturated, HFOs are olefins, otherwise known as alkenes. HFOs are being developed as "fourth generation" refrigerants with extremely low global-warming potential which is 0.1% of HFCs. HFO products have short atmospheric lifetimes and are categorized as having zero ODP (Ozone Depletion Potential) and low GWP (Global Warming Potential), providing a more environmentally friendly alternative to CFCs, HCFCs and HFCs. In addition, these blowing agents are non-inflammable.

PIR foams are used in many fields, both in construction for ceilings and walls and in ventilation and heating systems. Nowadays, these foams are most of times produced at industrial scale using hydrocarbons such as different isomers of pentane (isopentane, cyclopentane, n-pentane), but the use of HFOs seems to be a promising alternative for these materials because a lower thermal conductivity could be obtained together with an improved flame retardancy.

In this work, polyisocyanurate foams were synthesized with different types of blowing agents (isopentane, cyclopentane, HFOs, n-pentane and methylal). The effects of the type of blowing agent on the foaming process, cellular structure and changes in thermal conductivity have been analyzed exploring the advantages of using HFOs in comparison with other alternatives.

1. Maria Kurańska, Aleksander Prociak, Sławomir Michałowski, Karolina Zawadzińska, The influence of blowing agents type on foaming process and properties of rigid polyurethane foams.
2. Umberto Berardia, Jelena Madzarevicb, Microstructural analysis and blowing agent concentration in aged polyurethane and polyisocyanurate foams.
3. Mercedes Santiago-Calvo, Josías Tirado-Mediavilla, José Luis Ruiz-Herrero, a Fernando Villafañez and Miguel Ángel Rodríguez-Pérez, Long-term thermal conductivity of cyclopentane–water blown rigid polyurethane foams reinforced with different types of fillers.