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COMPUTATIONAL INVESTIGATION OF THE DYNAMICS OF PHYSICALLY BLOWN POLYURETHANE FOAM

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This study presents the mathematical modelling and simulation of physically blown polyurethane foam in a dedicated device considered in Tesser et al. (2003). For a given initial concentration of the physical blowing agent the final foam density was obtained via simulation. The temperature profile of the polymerization and curing process reported in the experiment of Tesser et al. (2003) was fitted to obtain the polymerization model equations and the associated model parameters. The present model considers the foam as a pseudo-homogeneous phase with the gas bubbles uniformly dispersed and the blowing agent transfer rate from the polymer liquid mixture to gas phase to be controlled by the heat generated from the chemical reactions. The foam growth behaviour of the investigated model uses Cyclopentane as the physical blowing agent. And the set of unsteady nonlinear coupled differential equations describing the foam process are solved using the Euler method, while the 3D simulation was performed on the FOAM software developed in ITWM. Observations of the temperature distribution, foam conversion, density profiles and blowing agent evaporation were reported and compared with results in literature.

Primary author: OPADIRAN, Sunday (Obafemi Awolowo University, Ile-Ife)

Co-authors: Dr NIEDZIELA, Dariusz (Fraunhofer Institute for Industrial Mathematics, Germany); Prof. OKOYA, Samuel (Obafemi Awolowo University, Ile-Ife)

Presenter: OPADIRAN, Sunday (Obafemi Awolowo University, Ile-Ife)

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