

NOVEL PROCESS FOR HIGH PRESSURE CO-POLYMERIZATION OF ETHYLENE AND ALKYNE CONTAINING CHEMICALS

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ABSTRACT

It is known that trace amounts of acetylene during the high pressure polymerization of ethylene to produce LDPE, leads to an uncontrollable reaction (runaway reaction) which produces excessive heat, and hence copolymerization involving ethylene and alkyne containing chemicals was not feasible for industrial purposes. For example, Zhang et al.¹, mentions that small amounts of impurities (e.g. acetylene) found in the reactor feed, can decompose into free radicals and induce runaway reactions.

With this investigation it is demonstrated that certain alkyne containing compounds do not cause these runaway reactions, contrary to acetylene under high pressure conditions. These alkyne containing compounds do not undergo a thermal decomposition during the applied reaction conditions, serving the intended mechanism of free-radical copolymerization with ethylene at high pressures.

The reactive group (C=C bond) in the alkyne containing compounds together with ethylene, react with the generated radicals and incorporates the C≡C bond in the growing polymer chain. It was found that C≡C bond does not react with the generated radicals under chosen reaction conditions (temperatures in the range of 100 °C to 350 °C and pressures from 150 MPa and 350 MPa) and is maintained in the copolymer obtained as branches of the main chain. No crosslinking originating from the C≡C bond was observed. It was therefore found that an ethylene copolymer having branches comprising C≡C bonds can be made according to the followed procedure.

This new type of high pressure ethylene copolymers can be used for various applications like films for packaging of bakery items, snack foods, consumer durables, disposable diapers, textiles, agricultural film, shrink film, medical packaging and cable insulations. Additionally, the incorporated alkyne bond can be used for further functionalization reactions.

References

¹Zhang et al.; Runaway Phenomena in Low-Density Polyethylene Autoclave Reactors, AIChE Journal, October 1996, 42, 10, 2920.