A POLYOL BLOCK COPOLYMER, COMPOSITIONS AND PROCESSES THEREFOR

Technical Field

The present invention relates to the process of producing a polyol block copolymer from a two step process carried out in two separate reactors, and products and compositions incorporating such copolymers.

Background

WO2015059068 and US 2015/0259475 (Equivalent of EP2888309) from Covestro disclose the use of a DMC catalyst for the production of polyether carbonate polyols from CO_2 and alkylene oxide in the presence of a starter compound. Many H-functional starter compounds are listed including polyether carbonate polyols, polycarbonate polyols and polycarbonates.

However, a DMC catalyst alone is limited in the amount of carbon dioxide it can incorporate into a polyethercarbonate polyol, requiring high pressures (generally more than 40 bar) to achieve a maximum of around 50 % of the possible CO_2 incorporation. Furthermore, a DMC catalyst requires a pre-activation step, usually in the absence of CO_2, which initially produces a polyether. CO_2 is then added and incorporated into the polymer structure. This means that a DMC catalyst alone cannot produce low molecular weight polyols (e.g. <1000 Mn) with substantial CO_2 content and the CO_2 content of the polyol is even restricted at higher weights such as 2000 Mn. Polyethercarbonate polyols produced by a DMC alone generally have a structure which is rich in ether linkages in the centre of the polymer chain and richer in carbonate groups towards the hydroxyl terminal groups. This is not advantageous as the ether groups are substantially more stable to heat and basic conditions than the carbonate linkages.

WO2010062703 discloses production of block copolymers having a polycarbonate block and a hydrophilic block (e.g. a polyether). A two pot production is described, using a carbonate catalyst in the first reaction to produce an alternating polycarbonate block, followed by quenching of the reaction, isolation of the polyol from solvents and unreacted monomers and then a second batch reaction with a DMC catalyst (in the absence of CO_2) to incorporate the hydrophilic oligomer, such as poly(alkylene oxide). The process can be used to produce B-A-B polymers where A is a polycarbonate and B is a hydrophilic block such as a polyether. The polymers have use in enhanced oil recovery.

The invention allows production of polycarbonate block polyether polyols containing significantly increased CO_2 content under mild pressures by using low molecular weight CO_2 containing polycarbonate polyols (produced by a carbonate catalyst in a first reaction) as starters for a reaction between DMC catalyst and epoxide. Unlike the polyether carbonate polyols produced by a DMC catalyst alone, the polycarbonate block polyether polyols produced by the invention can produce low molecular weight polyols (e.g. <1000 Mn) with substantial CO_2 content (e.g. > 7wt%).