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(54) **PROCESS FOR PRODUCING
POLYALKYLENE CARBONATES**

(75) Inventors: **Ulrich Müller**, Neustadt (DE); **Gerrit
Luinstra**, Mannheim (DE); **Omar M.
Yaghi**, Ann Arbor, MI (US)

(73) Assignees: **BASF Aktiengesellschaft**,
Ludwigshafen (DE); **University of
Michigan**, Ann Arbor, MI (US)

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(58) **Field of Search** **558/265; 585/18,
585/520**

(56) **References Cited**

PUBLICATIONS

Donald J. Darensbourg, et al., Bis 2,6-difluorophenoxide
Dimeric Complexes of Zinc and Cadmium and Their Phos-
phine Adducts: Lessons Learned Relative to Carbon Diox-
ide/Cyclohexene Oxide Alternating Copolymerization Pro-
cesses Catalyzed by Zinc Phenoxides, *J. Am. Chem. Soc.*
2000, vol. 122, No. 50,(2000) pp. 12487–12496.

Tsung-Ju Hsu, et al., Block copolymerization of carbon
dioxide with cyclohexene oxide and 4-vinyl-1-cyclohex-
ene-1,2-epoxide in based poly(propylene carbonate) by
yttrium-metal coordination catalyst, Elsevier, *Polymer*
Communication, *Polymer* 43(2002) pp. 4535–4543.

David R. Moore, et al., Electronic and Steric Effects on
Catalysts for CO₂/Epoxide Polymerization: Subtle Modifi-
cations Resulting in Superior Activities, *Agnew. Chem. Int.*
Ed.(2002) 41, No. 14, pp. 2599–2602.

Stephan Mang, et al., Copolymerization of CO₂ and 1,2-Cy-
clohexene Oxide Using a CO₂-Soluble Chromium Porphyr-
in Catalyst, *Macromolecules*(2000,) 33, pp. 303–308.

Primary Examiner—Taofiq Solola

(74) *Attorney, Agent, or Firm*—Oblon, Spivak, McClelland,
Maier & Neustadt, P.C.

(57) **ABSTRACT**

A polyalkylene carbonate, an alternating copolymer, may be
prepared by the ring opening of an alkene oxide or an alkene
oxide precursor in the presence of carbon dioxide or any
substance delivering carbon oxide, in the presence of at least
one catalyst comprising a metal-organic framework
material, wherein said framework material comprises pores
and a metal ion and an at least bidentate organic compound,
said bidentate organic compound being coordinately bound
to the metal ion.

20 Claims, 2 Drawing Sheets