Review and Investigation of Living Coordination Polymerization of Butadiene Monomer Using Neodymium-based Ziegler-Natta Catalysts

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Abstract

Polymerization of 1,3-butadiene monomer is performed using Ziegler-Natta catalysts based on different metal atoms such as Titanium (Ti), Cobalt (Co), Nickel (Ni) and Neodymium (Nd) by coordination mechanism. Neodymium-based catalysts have received much attention due to the high cis-polybutadiene rubber production. This paper studies the kinetics of butadiene monomer polymerization with ternary Ziegler-Natta catalysts consist of Neodymium salts as a catalyst, various alkylaluminums as a cocatalyst and alkylaluminum halides as a donor. Besides, the effect of the catalyst components on the polymerization reaction rate, molar mass and molar mass distribution of produced polymer will be investigated. It was found that halide donors affect the rate of polymerization reaction. Although the main effect of alkylaluminum (its types and amount) is on the molar mass, but the polymerization rate is also influenced by this compound. The linear behavior observed in the diagrams of molar mass versus monomer conversion indicates the living nature of polymerization. Polymerization of butadiene monomer in the presence of a variety of Nd-based catalytic systems can be a coordinative chain transfer polymerization (CCTP). The triblock polymers synthesized from butadiene with other monomers confirm the living nature of this catalytic system.

Keywords: Living Polymerization, Ziegler-Natta, Butadiene, Neodymium, Alkylaluminum.

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The Effect of Graphene Morphology on Natural Gas Hydrate Enrichment

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Abstract

In this research, a new method of parallel natural gas enrichment process has been introduced with the process of formation of gas hydrates, and the effect of graphene nanostructures has been investigated including graphene nanosheets, nanoporous graphene and graphene hammers on the process. For this purpose, first graphene nanosheets were synthesized by two method of chemical vapor deposition (CVD) and modified Hammers, then synthesized grapheme sheets and nanoporous graphene were functioned to measure their effect on the process. The crystalline and nano structure of all nanostructures was investigated by analyzing XRD, FTIR, SEM and BET. There nano fluids were prepared containing 1% by weight of nanostructures and was used in the process of natural gas hydrates formation containing 92.7% of methane under conditions of 6.9 kPa & 4oC. The results were compared by, a control sample containing 100 g of deionised water. After hydrate formation, by gradually increasing the reactor temperature and decomposition of 95% of the hydrate, released natural gas was sampled and compared with the GC analysis of its compounds. The results were showen an increasing of 3.48% and 4.6% of methane in the presence of nanoporous graphene and functionalized nanoparticle graphene, respectively and the removal of corrosive compounds such as carbon dioxide.

Keywords: Graphene, Enrichment, Hydrate, Stability.

Review of Methods for Increasing Efficiency in Thermal Power Plants and Study of Shazand Power Plant

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Abstract
Power plants are one of the most energy intensive industries in our country. This paper reviews the most common methods for reduction of energy consumption and increasing of efficiency in power plants. For steam power plants, several methods have been presented to recover waste heat and water in water blowdown and for heat integration with solar energy. For gas and combined cycle power plants, change in conditions of inlet air to gas turbine, use of solar energy and steam injection system have been investigated. Also, the proposed procedures for steam power plants have been applied in Shazand power plant. The results showed that the efficiency increased compared to the base case.

Keywords: Steam Power Plant, Gas Turbine Power Plant, Combined Cycle Power Plant, Energy Saving, Efficiency, Shazand Power Plant.

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Experimental Investigation of Shelled Corn Drying in Rotary Dryer With Experimental Design Software

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Abstract
Drying of solids is one of the oldest and most common types of operations used in a variety of industries including agriculture, chemical, food, and so on. The heat transfer mechanism in the dryer is often convection or conduction and a small amount of it is from radiation. In this research the drying of shelled corn in rotary dryer is evaluated, and the effect of inlet air temperature in range of 40-70 ℃ and rotational velocity in range of 5-15 rpm to responses including drying time (hr) and product outlet temperature (℃) is investigated using Experimental design of a central composite of response surface methodology. The initial and final moisture of shelled corn were 73% and 15% wet basis, respectively. The results showed that the drying time decreased with increasing the air temperature but increased with an increase in rotational velocity. The optimum conditions showed the air inlet temperature of 65/61 ℃ and the rotational velocity of 6.46 rpm was the best conditions for shelled corn drying in a rotary dryer.

Keywords: Drying, Rotary Dryer, Shelled Corn, Air Temperature, Rotational Velocity.

Application of Graphene for Producing of Clean Energy

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Abstract

The increasing consumption of fossil fuels and limited resources and the environmental problems cause to carry out extensive research on the replacement of new and clean energy resources. In recent years, researchers have focused on fuel cells, solar cells, lithium batteries and biomass as a clean energy reserves. Although these methods have disadvantages but the using of nanotechnology lead to solve significant drawback of these techniques. Graphene, as a carbon nanostructure, is a two-dimensional substance with hexagonal network and covalent bonds have unique properties including high electrical, mechanical, thermal, chemical, surface area and low density. These wonderful properties lead to graphene is considered as a good candidate in fuel cell, solar cell, ion battery and bio mass. Due to the importance of this issue, this paper reviews the graphene and its applications in clean energies.

Keywords: Graphene, Clean Energy, Fuel Cells, Solar Cells, Lithium Batteries, Biomass.

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Photocatalytic Conversion of Carbon Dioxide Gas to Valuable Chemicals and Hydrocarbon Fuels

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Abstract

Nowadays, due to the increasing problems caused by global warming, researchers have proposed several methods to reduce carbon dioxide emissions in the atmosphere. Among the conventional methods, the processes of Carbon Capture and Storage (CCS) and carbon dioxide conversion to useful products are great of importance. Meanwhile, photocatalytic conversion of CO_2 to valuable chemicals and hydrocarbon fuels, not only reduces concerns about the accumulation of this polluting gas but also creates a new pathway for the synthesis of carbon-dioxide derived compounds. This review article at first briefly studies carbon dioxide conversion technologies and then discusses the principles of carbon dioxide photocatalytic conversion. The main purpose of this paper is to investigate the effects of reducing agents among the various factors affecting the photocatalytic conversion of CO_2. Therefore, the effects of different reducing agents such as liquid water, steam, and hydrogen gas on carbon dioxide conversion and product distribution are studied. The results of this study indicate that various reducing agents cause different reaction mechanisms, and ultimately lead to the production of various products such as methanol, methane, formic acid, formaldehyde, and carbon monoxide. Next, in order to create the optimal conditions for conducting a reaction toward the desired product distribution with the highest yield, several reactions performed in the presence of these three reducing agents are compared. The selectivity of the conversion reaction is higher toward methanol in the presence of water. It means methanol is produced at a higher rate. However, the major products of photocatalytic reduction of carbon dioxide in the gas phase and in the presence of water vapor and hydrogen are methane and carbon monoxide.

Keywords: CO_2 Utilization-Photocatalytic Conversion of CO_2-Reducing Agents- TiO_2-Hydrocarbon Fuels-Methanol.