Patented Feb. 9, 1943

2,310,605

UNITED STATES PATENT OFFICE

2,310,605

PRODUCTION OF SULPHUR DIOXIDE-OLEFIN RESINS

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No Drawing. Application February 3, 1939, Serial No. 254,381

9 Claims. (Cl. 260—80)

This invention relates to resins of the sulphur dioxide-olefin type and to new and improved processes for producing them.

It has long been known that resinous polymerization products may be produced under proper conditions by the reaction of sulphur dioxide with active unsaturated organic compounds of the olefin type, of which the mono-olefins like ethylene, propylene, butene-1, butene-2, isobutene, pentene-1 and pentene-2 are examples. Other examples of such unsaturated compounds are butadiene, pentadiene and other conjugated diolefins; pentyne-1, hexyne-1 and other acetylenes; and poly-functional unsaturated compounds of the nature of allyl alcohol, vinyl acetate and allyl propionate. This reaction, however, takes place to a substantial extent only under the influence of catalysts. When carried out properly in the presence of a satisfactory catalyst, the reaction produces thermoplastic resins that are valuable for use in the manufacture of molded objects, as bases for lacquers, varnishes, etc., and for other purposes to which plastics are ordinarily applied.

The commercial development of resins of the sulphur dioxide-olefin type has been retarded by the lack of sufficiently active catalysts. Light of the proper wave length, oxidizing compounds such as certain peroxides and silver nitrate, and certain organometallic compounds have been disclosed heretofore as suitable catalytic agents. The known processes involve the reaction of sulphur dioxide and an active unsaturated organic compound, in a sealed glass tube or steel bomb, at comparatively low temperatures and in the presence of sunlight or another of these known catalysts. None of these catalysts, however, is capable of converting the reactants into the desired resinous product in an economically feasible period of time, many hours and even days being required to obtain a satisfactory yield, and in many cases resins are produced which are contaminated or discolored by the catalyst.

One of the objects of my invention is to secure a higher yield of resin in a given period of time than has heretofore been possible in the reaction between sulphur dioxide and unsaturated compounds of the olefin type by providing very active catalysts for the reaction.

Another object of my invention is to provide catalysts for the reaction which result in a high yield of resin within a very short period of time as compared with prior processes, periods of about an hour or less being required in accordance with this invention, instead of hours or days.

A further object of the invention is to provide an improved process for producing resins of the sulphur dioxide-olefin type which are not discolored by the decomposition of the catalyst.

Other objects and advantages of the invention may become apparent from the following description.

According to the present invention, I have found that the production of resinous polymerization products through the reaction between sulphur dioxide and active unsaturated organic compounds, such as the mono-olefins, can be practiced in a commercially feasible manner,—with large yields, a short reaction period and products free from undesirable contamination or discoloration,—by carrying out the reaction in the presence of ozonides, as catalysts. More particularly, I have found that valuable results are obtained when the catalyst is an ozonide that has been prepared under substantially anhydrous conditions. While certain ozonides may fail to produce useful results, for example, in the absence of proper control over the conditions of their preparation, or of their use in their resin-forming process, I have discovered that results far superior to any heretofore realized may be obtained by proper understanding of and control over the preparation and use of ozonides in accordance with the present disclosure.

It is believed that the reaction of olefins with sulphur dioxide is of the type commonly termed a "chain reaction" and yields high molecular weight polymeric substances which may be formulated:

$$—SO_2—R—SO_2—R—SO_2—R—$$

where R represents the olefin residue. This type of reaction requires an energizer to cause it to proceed. It is my belief that the ozonides, which are relatively unstable compounds, furnish the energy necessary for activation of the reagents through their own decomposition, which may be brought about by sulphur dioxide, water and various other substances. The outstanding results obtained by carrying out the polymerization reaction in the presence of ozonides prepared under anhydrous conditions may therefore be explained by the postulation that if the ozonide comes into contact with a material that causes its decomposition before it is introduced into the reaction mixture, then the energy release is accomplished and no catalytic effect is obtained.

In carrying out my process for the produc-