EFFECT OF PHENOLIC ANTIOXIDANTS ON POLYCHLOROPRENE BASED ADHESIVES

DISSERTATION SUBMITTED

BY

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ABSTRACT

This project reviews the degradation of polychloroprene based adhesives. The first step in the oxidative degradation is the allylic hydrogen abstraction leading to different radicals. Some hydroperoxides are formed and then decomposed into alcohol, ketones, acid chlorides and acids. Acid value and tintometer colour measurements are used to identify the amount of acid released and hence the extent of degradation. The influence of phenolic antioxidants on the oxidative degradation is studied.

Phasing occur in a polychloroprene based adhesive when the metal oxide and the resin particles are not fully reacted. Eventually these unreacted particles settle down at the bottom of the container. Among other factors the polarity of the solvent system solvent strength, material type the shape and the size of the resin and metal oxides are also important. A physical method to minimize phasing is studied.

TABLE OF CONTENTS

Chapter 1

INTRODUCTION

1.0 ADHESIVES

An adhesive may be defined as a material which when applied to surfaces of materials can join them together and resist separation. The general term "adhesives" includes cement, paste and glue. [1]

Adhesives were utilized in a sophisticated manner even in ancient times. Carvings in Thebes dated 3000 years back depict the gluing of a thin piece of veneer to what appears to be a sycamore plank. The glue pot and brush are shown, still earlier, in the palace of Kossos in Crete. Wet lime was the binder for chalk, iron ocher, and copper blue frit pigments with which the walls were painted. The Egyptians utilized gum Arabic from the acacia tree, egg, glue, semiliquid balsams and resins from trees. Wooden coffins were decorated with pigments bonded with "gesso" a mixture of chalk and glue.[6]

Until early part of this century, the only adhesives of major importance were the animal and vegetable glues which had been in use for thousands of years. These materials are still employed for bonding porous materials such as paper. Caseian glues were used in the aircraft industry during world war I. It was found that Casiean glue used on the wooden structures had limited resistance to moisture and to mould growth. These limitations of natural adhesives provided the stimulus for experimentation which caused the expansion in the development of new adhesives since 1930's. Those studies introduced new adhesives based on synthetic resins together with other materials. The most advantageous features of the new adhesives over the earlier types is their excellent resistance to moisture, mould growth, and the ability to withstand a variety of demanding service conditions.

Phenol Formaldehyde was the first synthetic resin of importance to adhesive bonding. It is used mainly for wood assembly and plywood manufacture. Later the demands of aircraft industry for materials suitable for metal bonding led to the introduction of modified Phenolic resins containing synthetic rubber components to form adhesives displaying high shear and peel strength.

The 1950s saw the introduction of epoxy resin based adhesives, offering equal strength properties together with processing advantages with 100% reactive solids systems.

Today the variety of applications of adhesives is large, ranges from industrial processes using considerable amounts to assembly jobs which utilizes small quantities of adhesives.

The classification of adhesives within a single parameter is not feasible without the contradiction of some principle of the particular classification, as some adhesives may qualify for entry under several headings.

The following is a broad scheme based on the origin, physical and chemical type of the main ingredient of the adhesive formulation. [1] Table 1.1

According to the table the adhesives are classified into two major groups, natural and synthetic according to their origin. Synthetic adhesives are divided further into elastomer, thermoplastic, and thermosetting adhesives. From that, polychloroprene adhesives which is the main focus of this research falls into the synthetic elastomer adhesive category.