International Journal of Science and Research (IJSR)
ISSN: 2319-7064
ResearchGate Impact Factor (2018): 0.28 | SJIF (2019): 7.583

Chemistry of Polysulfide Impression Material

Vidhya. T. K

Graduate Student, Saveetha Dental College, Saveetha University, Saveetha Institute of Medical and Technical Sciences

Abstract: ***The base plate , is a polysulfide polymer that contain a multi-functional mercaptan (-SH) called a polysulfide polymer, a suitable filler such as lithopone or titanium dioxide to provide the required strength a plasticizer (dibutyl phthalate) to confer appropriate viscosity to the paste and a small quantity of sulphur, approximately 0.5% as an accelerator the catalyst paste contains lead dioxide , filler and plasticizer as in the base paste, and oleic stearic acid as a retarder to the control the rate of the setting reaction***

Keywords: polysulfide, impression, polymer

1. Introduction

A dental impression is a negative imprint of hard teeth and soft tissues in the mouth from which a positive reproduction can be formed. They are made by using a container which is designed to roughly fit over the dental arches. Impression materials are designed to be liquid or semi-solid when first mixed and placed in the tray, and then quickly set to a solid (usually a few minutes depending upon the material), leaving an imprint of the structures in the mouth.

Polysulfide

The base plate , is a polysulfide polymer that contain a multi-functional mercaptan (-SH) called a polysulfide polymer, a suitable filler such as lithopone or titanium dioxide to provide the required strength a plasticizer (dibutyl phthalate) to confer appropriate viscosity to the paste and a small quantity of sulphur, approximately 0.5% as an accelerator the catalyst paste contains lead dioxide , filler and plasticizer as in the base paste, and oleic stearic acid as a retarder to the control the rate of the setting reaction. Lead oxide is the component that gives poly sulphide impression material it characteristic brown color. The term catalyst and accelerator used here and with other impression materials are actually misnomers. Reactor is a more appropriate term for the reaction associated with polysulfide and other types of impression materials. (1)

Each paste is supplied in a dispensing tube with approximately sized bore diameter at the tip so that equal length each paste are extruder from each tube to provide the current ratio of polymer cross linking agent. Since the composition of the material in the tube is balanced with that of the accelerator, the matched tubes supplied by the manufacturer should always be used.

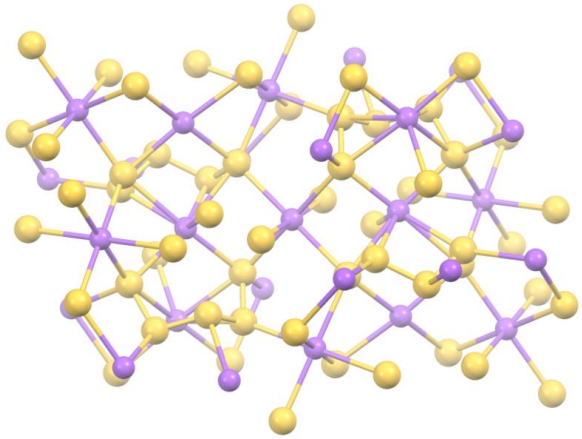
The reaction starts the beginning of mixing and reaches its maximum rate soon after spatulation is complete. Moisture and temperature have significant effect on the course of the reaction. In particular, hot and humid conditions will accelerate the setting of polysulfide impression materials. The reaction yields water as a by-product. Loss of this small molecule from the set material has a significant effect on the dimensional stability of the impression.

Chemistry

Polysulfides are a class of chemical compounds containing chains of sulfur atoms. There are two main classes of polysulfides: anions and organic polysulfides. Anions have the general formula S_{2-n}. These anions are the conjugate bases of the hydrogen polysulfides H_2S_n. Organic polysulfides generally have the formulae RSnR, where R = alkyl or aryl. The alkali metal polysulfides arise by treatment of a solution of sulfide, e.g. sodium sulfide, with elemental sulfur:(2,3).

$$S^{2-} + n\ S \rightarrow S_{n+1}^{2-}$$

In some cases, these anions have been obtained as organic salts, which are soluble in organic solvents. The energy released in the reaction of sodium and elemental sulfur is the basis of battery technology. The sodium–sulfur battery and the lithium–sulfur battery require high temperatures to maintain liquid polysulfide and Na+-conductive membranes that are unreactive toward sodium, sulfur, and sodium sulfide. (4) The compound $(C_5H_5)_2TiS_5$ is an example of a polysulfide complex. Polysulfides are ligands in coordination chemistry. Examples of transition metal polysulfido complexes include $(C_5H_5)_2TiS_5$, $[Ni(S_4)_2]^{2-}$, and $[Pt(S_5)_3]^{2-}$.[5] Main group elements also form polysulfides.[6]



In commerce, the term "polysulfide" usually refers to a class of polymers with alternating chains of several sulfur atoms and hydrocarbons. They have the formula R_2S_x. In this formula x indicates the number of sulfur atoms (or "rank"). Polysulfide polymers can be synthesized by condensation polymerization reactions between organic dihalides and alkali metal salts of polysulfide anions:

$$n\ Na_2S_5 + n\ ClCH_2CH_2Cl \rightarrow [CH_2CH_2S_5]_n + 2n\ NaCl$$

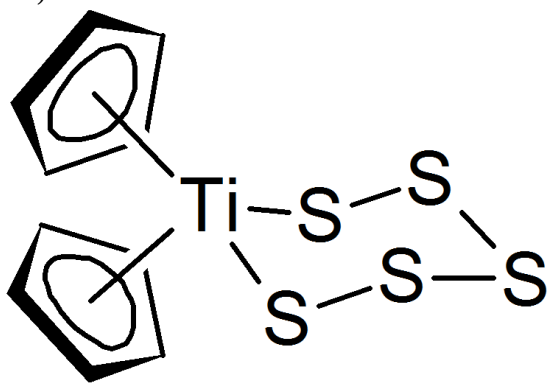
Dihalides used in this condensation polymerization are dichloroalkanes (such as 1,2-dichloroethane, bis-(2-chloroethyl)formal ($ClCH_2CH_2OCH_2OCH_2CH_2Cl$), and

Licensed Under Creative Commons Attribution CC BY

1,3-dichloropropane). The polymers are called thiokols. In some cases, polysulfide polymers can be formed by ring-opening polymerization reactions.

Polysulfide polymers are also prepared by the addition of polysulfanes to alkenes. An idealized equation is: 2 RCH=CH2 + H2Sx → (RCH2CH2)2Sx

In reality, homogeneous samples of H2Sx are difficult to prepare.Polysulfide polymers are insoluble in water, oils, and many other organic solvents. Because of their solvent resistance, these materials find use as sealants to fill the joints in pavement, automotive window glass, and aircraft structures. Polymers containing one or two sulfur atoms separated by hydrocarbon sequences are usually not classified polysulfides, e.g. poly(p-phenylene) sulfide (C6H4S)n.



2. Conclusion

Many commercial elastomers contain polysulfides as crosslinks. These crosslinks interconnect neighboring polymer chains, thereby conferring rigidity. The degree of rigidity is related to the number of crosslinks. Elastomers therefore have a characteristic ability to "snap back" to their original shape after being stretched or compressed. Because of this memory for their original cured shape, elastomers are commonly referred to as rubbers. The process of crosslinking the polymer chains in these polymers with sulfur is called vulcanization. The sulfur chains attach themselves to the "allylic" carbon atoms, which are adjacent to C=C linkages.

References

[1] Elsevier eBook on VitalSource Phillips' Science of Dental Materials - Elsevier eBook on VitalSource, 11th Edition
[2] Fujimori, Toshihiko; Morelos-Gómez, Aarón; Zhu, Zhen; Muramatsu, Hiroyuki; Futamura, Ryusuke; Urita, Koki; Terrones, Mauricio; Hayashi, Takuya; Endo, Morinobu; Young Hong, Sang; Chul Choi, Young; Tománek, David; Kaneko, Katsumi (2013). "Conducting linear chains of sulphur inside carbon nanotubes". Nature Communications. 4. doi:10.1038/ncomms3162. PMC 3717502Freely accessible. PMID 23851903.
[3] Steudel, Ralf (2007). "Sulfur: Organic Polysulfanes". Encyclopedia of Inorganic Chemistry. Weinheim: Wiley-VCH doi:10.1002/0470862106.ia233.pub2.
[4] Dev, S.; Ramli, E.; Rauchfuss, T. B.; Wilson, S. R. (1991). "Synthesis and Structure of [M(N-Methylimidazole)6]S8: Polysulfide Salts Prepared by the Reaction N-Methylimidazole + Metal Powder + Sulfur". Inorg. Chem. 30 (11): 2514. doi:10.1021/ic00011a011.
[5] Draganjac, M. E.; Rauchfuss, T. B. (1985). "Transition Metal Polysulfides: Coordination Compounds with Purely Inorganic Chelate Ligands". Angew. Chem. Int. Ed. Engl. 24: 742. doi:10.1002/anie.198507421.

Licensed Under Creative Commons Attribution CC BY