J. Civil Eng. Mater.App. 2020 (September); 4(3): 155-160

Journal of Civil Engineering and Materials Application

Journal home page: http://jcema.com

Received: 16 June 2020 • Accepted: 29 August 2020

Research

doi: 10.22034/jcema.2020.237399.1029

Fourier Transform Infrared Characterization of Construction Joint Sealants

Aschalew Kassu [1]*, Kwaneitra Powers [1], William Petway [1], Anup Sharma [2]

[1] Department of Mechanical, Civil Engineering and Construction Management, Alabama A&M University, U.S.A.

[2] Department of Physics, Chemistry, and Mathematics, Alabama A&M University, U.S.A.

*Correspondence should be addressed to Aschalew Kassu, Department of Mechanical, Civil Engineering and Construction Management, Alabama A&M University, U.S.A. Tel: +7033310952; Fax: +7033310952; Email: aiquadri@futa.edu.ng.

ABSTRACT

This paper presents the results of the FTIR (Fourier-Transform Infrared) spectroscopy study of commercially available silicone-based sealant materials commonly used for sealing voids, cracks, and joints in non-structural building components of commercial and residential buildings. The sealants prevent moisture leakage through the parts, making the building envelope air and water-tight, sustainable, and energy-efficient. FTIR spectroscopy is a widely used technique in characterizing pharmaceutical products, mineralogical compositions, forensic analysis, food, chemical, semiconductor, petroleum, and agro-industries. This work demonstrates the application of FTIR analysis in the study of construction materials. It reports the IR (Infrared) spectral signatures of the selected building joint sealants used in the construction industry. It is found that several IR bands are common to most of the samples, suggesting that there is a reasonable similarity in the molecular composition of the three different manufacturer brands, including DAP (Dicks-Armstrong-Pontius), GE (General Electric), and HDX (Home Depot Product). Despite the multiple similarities in the IR bands of the samples studied, the FTIR techniques provided enough evidence to distinguish the samples and suggest that the composition and molecular structures of most of the silicone brands possess unique IR signatures.

Keywords: FTIR analysis of building materials, Silicone joint sealant, Characterization of construction materials, FTIR bands of building sealants, Characterization of silicone sealants, FTIR spectroscopy.

1. INTRODUCTION

Silicone is produced in the form of elastomers, fluids, gels, and fluids. These products have been used for various purposes in different sectors, including construction, automotive, electrical and electronics, pharmaceutical, and other industries [1-4]. The hydrophobic nature of silicone rubber also makes it one of the primary materials of choice for coating materials and parts exposed to varying environmental conditions [4]. In 2018, the construction industry was the major consumer of silicone, followed by transportation (aerospace and automotive) and electrical and electronics industries. In the coming years, the market share of silicone in the construction sector is projected to grow globally [5]. Despite its gradual aging and degradation, in building construction, silicone is a widely used hydrophobic polymer having excellent weathering resistance and durability [1]. The applications include sealing voids, cracks, and joints in non-structural building components (windows and door frames, between panels), which prevents moisture leakage through the parts, making the building envelope air and water-tight, sustainable and energy-efficient construction [1,2]. Sealed joints and cracks in building envelope also minimize smoke leakage to adjacent rooms and buildings [6], retain heat within the building envelope, and reduce energy use and utility cost [1].