Polyvinylidene fluoride heterogeneous alkaline reaction mechanism in propan-2-ol

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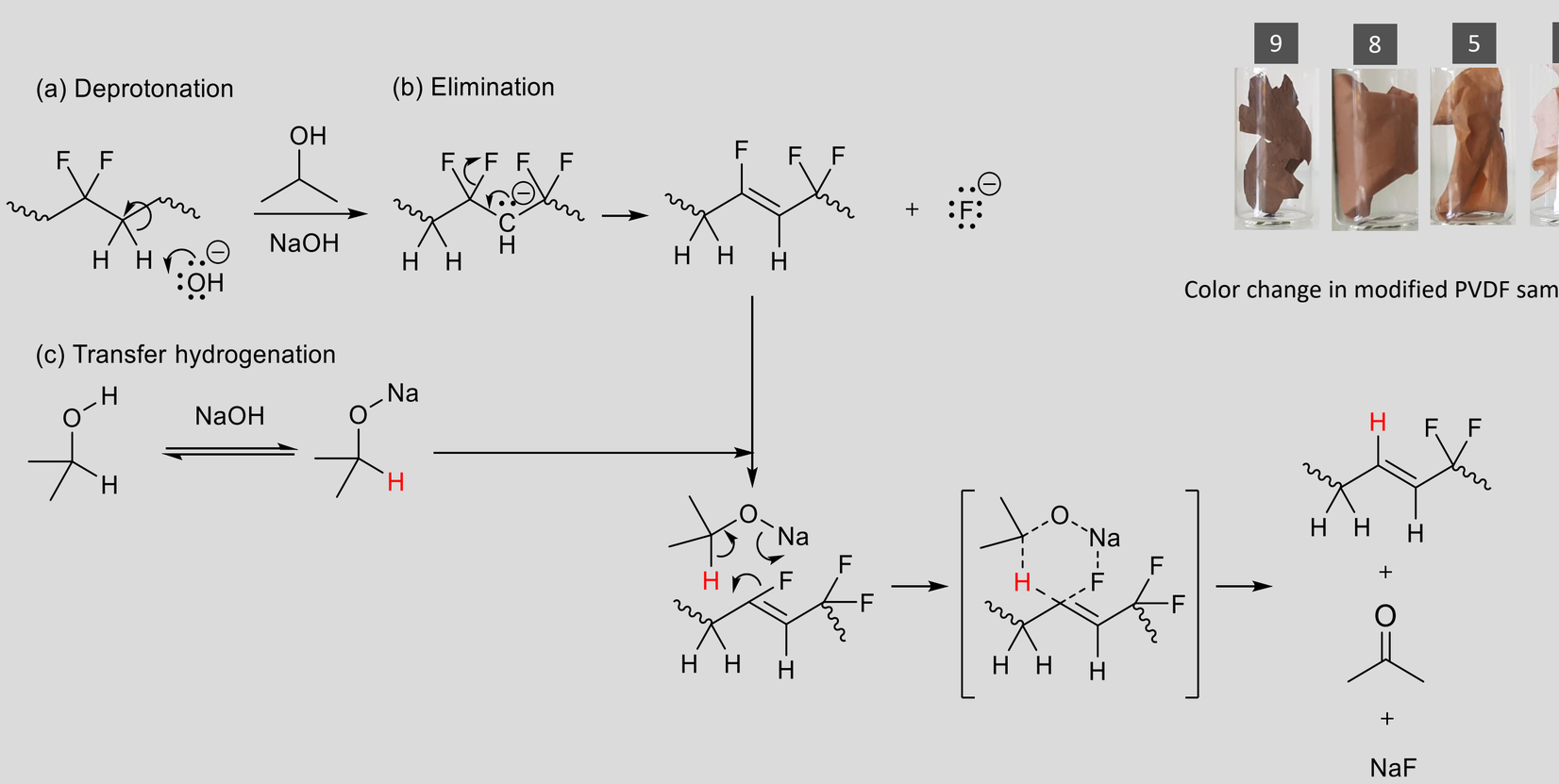
Abstract

A new reaction mechanism for Polyvinylidene fluoride alkaline reaction in propan-2-ol is proposed. Sodium isopropylacoholate catalyzed the C_{sp2}—F bond cleavage in a transfer hydrogenation step and results in the formation of C_{sp2}—H bond, a mechanism supported by the presence of acetone.

Introduction

The reaction of PVDF and alkaline solutions is recognized as a key surface functionalization method and hence has been studied repeatedly over the past three decades for improving various inherent characteristics such as electrical conductivity, adhesiveness, or wetting properties[1–2]. The aim of this work is to study the mechanism of PVDF reaction with NaOH in propan-2-ol, focusing on group theory and symmetry tools in analyzing the vibrational modes of the dehydrofluorinated PVDF for a better understanding.



Scheme 1. Proposed mechanism for PVDF dehydrogluorination. (a) deoritonation, (b) elimination, (c) transfer hydrogenation.

Color change in modified PVDF samples at 60°C (1–4) and 80°C (5–9) vs pristine sample (0), ordered by color gradient.

Methodology

The aim of this work is to study the mechanism of PVDF reaction with NaOH in propan-2-ol, focusing on group theory and symmetry tools in analyzing the vibrational mode of the dehydrofluorinated PVDF in FTIR spectra for a better understanding.

Results and discussion

FTIR spectra of the treated PVDF nanofibers displayed functional groups signals, where two distinct FTIR spectra were observed based on the reaction variables. The first spectra displayed no new bands (silent spectra).

The silence of the double bond signal within FTIR spectra implies that the rule of mutual exclusion is in effect, whereby all IR active vibrational modes are Raman inactive and vice versa. Hence the structure of the product displaying silent FTIR spectra is the hydrated conjugated structure.

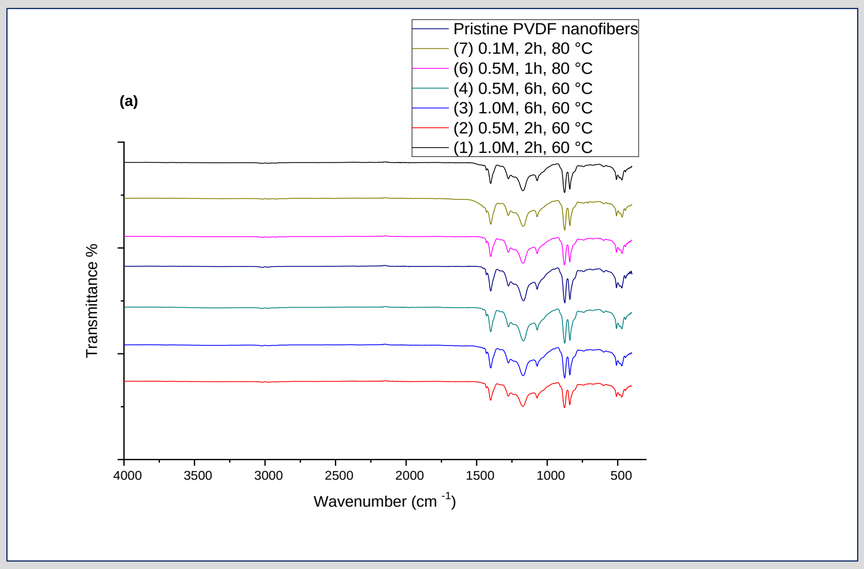


Figure1. (a) Silent and (b) active FTIR C=C graphs of pristine and post reaction PVDF nanofibers

References

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This work was supported by the Student Grant Competition (SGS) project at the Technical University of Liberec in 2021