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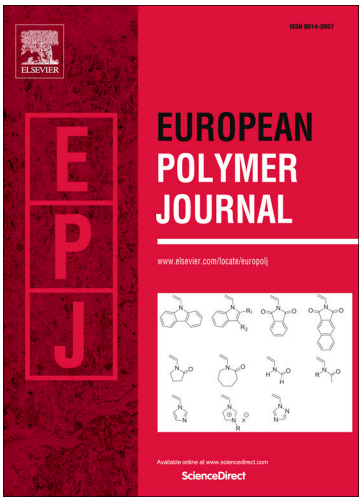

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Oscillatory Chemical Reactions In The Quest For Rhythmic Motion of Smart Materials

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Abstract

Oscillatory chemical reactions have been drawing the attention of researchers for a number of decades. More recently, the ability of the reactions to work as the driving force for smart materials became attractive in the quest for biomedical applications, such as pulsatile drug delivery and controlled tissue proliferation. Owing to recent developments in the field, these fascinating reactions have advanced from taking place in solution to polymer based soft materials. In this review we discuss the current state of the art and steps on the way to fully autonomous all-polymeric rhythmic materials and share our personal perspective about the future of oscillatory chemical reactions.

Key words

Oscillatory chemical reactions; smart materials; rhythmic materials; oscillatory carbonylation reaction; Belousov–Zhabotinsky reaction;

Introduction

While oscillatory chemical processes as natural phenomena are millions of years old, their systematic studies have more recent origins and what can only be described as a very bumpy journey to scientific recognition. The first published records of oscillations in chemical systems date from 1828, when Fechner described oscillating current produced by an electrochemical cell [1], however the research area was not firmly established until the mid-1970s. It took numerous recordings of oscillatory behavior, mathematical modelling and discussions of the observed phenomena throughout the 19th and 20th centuries before the academic community was convinced that oscillatory chemical reactions are genuinely feasible chemical processes, where the concentration of a