

KINETIC STUDY OF CEMENT-ASBESTOS THERMAL DECOMPOSITION PROCESS UNDER ISOTHERMAL CONDITIONS

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ABSTRACT

Asbestos is a general name applied to a group of silicate minerals which naturally occur in fibrous form. It is a natural mineral widely used in the past, especially in the construction industry. Despite its good performance properties, it is currently known that asbestos has carcinogenic properties. The problem of storing asbestos wastes is significant worldwide. This especially applies to countries where the production and use of asbestos products is prohibited by law. One of the possible methods of proceeding and solving the above problem is a thermal treatment, which results in thermal decomposition of dangerous asbestos fibers. The kinetic study of the thermal decomposition process carried out for cement-asbestos has been investigated by ex-situ thermal treatment. Obtained results allow for kinetic interpretation of this thermal transformation. The kinetic analysis of the isothermal data using an Avrami model yields values for the overall reaction order. The apparent activation energy of the thermal decomposition process for tested cement-asbestos sample is about 160 kJ/mol.

Keywords: cement-asbestos, thermal decomposition, kinetic study, isothermal

INTRODUCTION

Asbestos is not a term for a specific mineral, but a general name that covers fibrous varieties of silicate minerals from the serpentine and amphibole groups. Chemically, they are hydrated metal silicates, containing mainly Mg, Na, Ca or Fe. A characteristic feature of these minerals is their fibrous structure [1].

Asbestos minerals are a material with specific physical and chemical properties, used in a very wide range since the beginning of the 20th century. It has been used in approximately 3,000 products, including in the construction, chemical, transport, shipbuilding and professional energy industries [1,2]. The largest amounts of asbestos were used in construction for the production of insulating and cladding cement-asbestos boards and roofing. The cement-asbestos building materials (in Poland known also as 'eternit') were a very cheap and easy to produce an assortment of building materials. It is estimated that more than 85 % of the consumed asbestos in Poland alone, was used for the production of this type of building materials [3].

On the other hand, the carcinogenic properties of asbestos are now widely known [4]. They result primarily from the characteristic fibrous crystalline structure. In many countries, the use of asbestos has been banned and all materials containing asbestos are treated as hazardous materials or waste. It is common practice to deposit such waste in special landfills. The problem of waste containing asbestos concerns both asbestos used in the past and currently found in buildings and devices [5,6,7].