LEMBAR
HASIL PENILAIAN SEJAWAT SEBIDANG ATAU *PEER REVIEW*
KARYA ILMIAH : JURNAL ILMIAH

Judul Jurnal Ilmiah (Artikel)	:	Synthesis of Zeolite from Geothermal Waste		
Jumlah Penulis	:	3 orang (**Sulardjaka**, D.F. Fitriyana, A.P. Adi)		
Status Pengusul	:	penulis ke-1		
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Semarang, 2 November 2020

Reviewer 2

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NIP. 197108181997021001
Unit Kerja : T. Mesin FT UNDIP

Reviewer 1

Ir. Eflita Yohana, M.T., Ph.D.
NIP. 196204281990012001
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Semarang, 2 November 2020
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Dr. Agus Suprihanto, S.T, M.T.
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Sulardjaka, Fitriyana, D.F., Adi, A.P.

Departement of Mechanical Engineering, Jl. Prof. Sudarto, SH, Semarang, 50275, Indonesia

Abstract

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The high content of silica in geothermal waste can be used as an alternative source of amorphous silica for the production of silicon based materials. In this research, geothermal waste was used as silica sources in hydrothermal reaction of zeolite synthesis. Zeolite was synthesized by unstirred hydrothermal process. Hydrothermal process was conducted at variation temperature of 100, 110 and 120 °C during 5 hours. In order to study the effect of holding time on hydrothermal product, hydrothermal process was performed for different holding times of: 1, 3 and 5 hours at the temperature 120 °C. All of hydrothermal products were characterized by XRD. The results showed hydrothermal process successfully converts geothermal waste into zeolite A and sodalite. © (2014) Trans Tech Publications, Switzerland.

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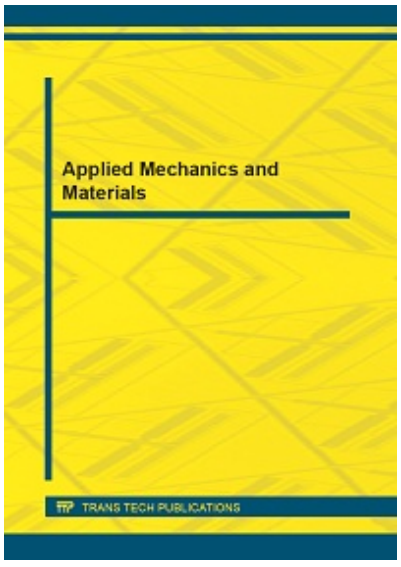

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Synthesis of Zeolite from Geothermal Waste

Sulardjaka[1, a], D.F. Fitriyana[1, b] and A.P. Adi[1, c]

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Keywords: geothermal waste, hydrothermal, zeolite A, sodalite.

Abstract. The high content of silica in geothermal waste can be used as an alternative source of amorphous silica for the production of silicon based materials. In this research, geothermal waste was used as silica sources in hydrothermal reaction of zeolite synthesis. Zeolite was synthesized by unstirred hydrothermal process. Hydrothermal process was conducted at variation temperature of 100, 110 and 120 ^{o}C during 5 hours. In order to study the effect of holding time on hydrothermal product, hydrothermal process was performed for different holding times of: 1, 3 and 5 hours at the temperature 120 ^{o}C. All of hydrothermal products were characterized by XRD. The results showed hydrothermal process successfully converts geothermal waste into zeolite A and sodalite.

Introduction

In recent year, production of worldwide electricity based on geothermal sources has increased significantly. As a country that located at the ring of fire, Indonesia has a high potential for geothermal energy. The Indonesian Geological Agency reported geothermal potential for power plant in all Indonesian areas is about 27,441 MW. However, the use of geothermal as energy resources produces geothermal waste. The geothermal power plant produces geothermal sludge and geothermal brine. Most of geothermal waste is of environmental concern, since geothermal waste contains elevated amounts of boron, ammonia, arsenic, and heavy metals compared to ordinary soil [1]. Such amount of geothermal waste cannot directly be disposed into a landfill without prior treatment [2]. Characterization of geothermal waste reported that the major constituent of geothermal waste is silica [3].

The problem of the waste resulted from geothermal power plants is now considered as an opportunity to encourage the precipitation of useful silica by product. The silica has a relatively large specific surface area, which makes it become interesting for several applications. The high content of silica in geothermal waste, was used as partial replacement of Portland cement [4,5]. Utilization of geothermal waste in producing new useful materials is here with the new research area that will expand the positive reuse of this abundant material. It's helping to reduce the environmental and economical impacts of its disposal.

Zeolite is a crystalline microporous solid that has regularity of cavities, channels with molecular dimensions and the diverse framework chemical compositions. There are two kind of zeolite, natural zeolite and synthesized zeolite. Synthesized zeolite is generally produced from hydrothermal reaction of sodium aluminosilicate gel prepared from various silica and alumina [6]. Factors that determine the type of synthetic zeolite produced are time of reaction, temperature, pressure, and synthesis conditions (like the order of mixing, gel aging, and stirring).

The main problem of synthesized zeolite production is the availability and cost of raw material specifically the silica source [7]. For reducing the production cost of synthesized zeolite, many researchers considered alternative materials as silica source. Zeolites A, X and hydroxysodalite (HS) were successfully synthesized from a natural Iranian kaolinite [8]. Wajima et.al (2006) also synthesized zeolite at low temperature (90 ^{o}C) from paper sludge ash, with addition of diatomite [9]. Na-X zeolite and X zeolite was also synthesized from solid by-product of oil shale processing [10]. High amount of silica in rice husk were used by many researcher as silica source at zeolite synthesized [11,12]. Coal fly ash was also an interesting materials as starting precursor of synthesized zeolite [13,14]. Previous experiments reported that geothermal waste contains silica.

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Influence of the supplementary cementitious materials on the dynamic properties of concrete

Elbachir Elbahi [1,a], Sidi Mohammed El Amine Boukli Hacene [1,b]

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Keywords: Concrete, Non-destructive test, Dynamic elasticity modulus, Crushed limestone, Résistance, Natural pozzolan.

ABSTRACT:

The resonance frequency method is one of many non-destructive tests which allow us to evaluate construction materials. It was used to determine the dynamic properties of concrete, required in structures design and control, also considered as the key elements for materials dynamic. In this study, we chose a non-destructive approach to quantify -in laboratory-, the influence of adding "crushed limestone" and "natural pozzolan" on local concrete's dynamic characteristics. However, several concrete mixtures have been prepared with limestone aggregates. The experimental used plan, allowed us to determine the dynamic modulus of elasticity, the dynamic modulus of rigidity of different formulated concretes.

1. INTRODUCTION:

To evaluate the state of the concrete structures and estimate their remaining life, the tests by the indirect methods are particularly interesting and represent the quality control of the structure. Among the advantages of these tests, we can mention the economy of materials, time and testing tools. Some characteristics of concrete are essential in the design and the control of structures. From these characteristics, we have the longitudinal elasticity modulus, the transversal modulus of elasticity, and Poisson's ratio [1]. The transversal modulus of elasticity and the Poisson's ratio form in the case of traverse strain or shear and appear in the calculation rules (EUROCODE, CBA, BAEL, and RPA) precisely in the verification of cutting effort, when the longitudinal elasticity modulus step in the calculation of deflection and effect from creep and shrinkage of concrete .the dynamic modulus of elasticity is considered equal to the tangent modulus of elasticity at the origin determined by the static tests .The dynamic modulus of elasticity is easy to measure, the static module knowledge of which is necessary for the conception of concrete structures. To know the relation and check the influence of the addition of natural pozzolan and crushed limestone, we followed a non-destructive approach based on the measurement of the resonance frequency on cylindrical specimens 16x32 cm [6].

2. CHARACTERIZATION OF USED MATERIALS:

The cement that we have used in this study is a CPJ CEM cement type, which belongs to the Algerian standard NA44 from the cements society of BENIE SAF in AIN TEMOUCHENT. For making deferent types of concrete, we used potable water that is distributed by public service network of CHITOUANE DAIRA of TELEMCEN city. Aggregates and fillers used are of a great career of TELEMCEN region, named career DJBEL ABIOD SIDI ABDELI which belongs to the national company of aggregates (ENG), these crushed limestone aggregates are marketed as grading: sand 0/3 and gravel 3/8; 8/16 and 16/25. Pozzolan used is also from BENIE SAF.

The analyses of the chemical composition of cement, natural pozzolan, and limestone fillers are recorded in table 1, those concerning the properties of aggregates were performed in our laboratory [10] [3], [4], [5].

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Effect of Nitriding on Reaction Layer of Diffusion Bonded Sialon to AISI 420 Martensitic Stainless Steel

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Abstract. Joining sialon to as-received and nitrided AISI 420 martensitic stainless steels using diffusion bonding is reported in this paper. The samples were joined at 1200°C for one hour under uniaxial pressure of 17 MPa in a vacuum ($1x10^{-5}$ Torr). After joining process, the microstructure, interdiffusion of elements, and hardness of the joint were studied. The interdiffusion and reactivity of the elements created the reaction layer. It consisted of interface layer on the sialon side whereas thicker diffusion layer was formed on the steel side. Thinner reaction layers were observed in joining sialon to nitrided steels compared to joining sialon to as-received steel due to less reactivity between the joined materials. However, more precipitates such as carbides were formed in the parent steel with longer nitriding time. Gaps were formed between the diffusion layer and the parent steel but the interfacial bonds were strong since no cracking occurred on the samples. Since the reaction layer had intermediate hardness, it contributed to the joint's ductility that reduced the effect of thermal expansion mismatch between the joined materials by acting as a shock absorbing zone.

Introduction

Joining ceramic to metal has been attempted by many researchers in the last decade. Most of the works consist of joining metal to; alumina [1-3], silicon carbide [4,5], silicon nitride [6-11], and sialon [12-16]. Ceramics comprise of ionic or covalent bonds, or by mixed ionic-covalent bonds, while metals have metallic bonding. The type of bonding influences the material properties such as hardness and coefficient of thermal expansion (CTE). Therefore, joining ceramic to metal is not an easy task because development of high residual stresses at the joint upon the process completion. The high stresses that are developed at this region lower the integral strength of the ceramic and subsequently, increasing the tendency to fracture. Despite formation of crack at the ceramics, joining them to metals is still possible at suitable bonding parameters. Formation of a thicker reaction layer illustrates higher reactivity between the joined materials during joining process. It was claimed that the reaction layer thickness decreased and less silicides were formed when joining sialon with longer nitrided steel due to less decomposition of sialon [12,14]. The brittle nature of silicides increased the possibility for the failure to occur at the joint [8,10]. Formation of ductile reaction layer contributed to the joint's successfulness. The formed layer was believed to be ductile because it possessed intermediate properties such as hardness between the steel and the sialon. It reduced the effect of thermal expansion misfit by acting as a flexible layer to absorb the excessive residual stress. From the previous works, there were no emphasis on determining the phases at the reaction layer for joining sialon to nitrided martensitic stainless steel [15,16]. Therefore, distribution of the phases at the interface is still not fully understood and with regard to the critical role for achieving the joint, understanding the reaction layer is important.

The objective of this work is to investigate the solid joining of sialon to AISI 420 martensitic stainless steel using diffusion bonding process. Samples of the steel were nitrided in order to study the effect of nitrogen pre-treatment on the reaction layer in terms of the microstructure, interdiffusion of elements, and hardness across the joint.