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Potential Advanced Ceramics from Kan Khunit Sint Lake, Demawso, Kayah State

Shwe Sin Oo [*1]

Abstract

Clays occurred in huge quantities, need improvement by stabilization or by replacing them with granular material. Currently, nanotechnology based Advanced Ceramics has changed our vision, expectations and abilities to control the material world. The developments in nano-science can also have a great impact on the field of construction materials. Portland cement, one of the largest commodities consumed by mankind, is obviously the product with great. Nano-reinforced composite building materials were developed on the base of quartz raw material. In this preliminary work, the structural analysis of the clay samples from Kan Khunit Sint lake, Demawso Township, Kayah State, in air at the room temperature were investigated by EDXRF (Energy Dispersive X-ray Fluorescence) and XRD (X-ray Diffraction Analysis). The tridymite SiO_2 (lower temperature range) formed as nano-SiO_2 (~71 nm) in the clay samples and others materials Si, Fe, Ca, K, Ti, Mn, and Zr were detected. It is also called nanoclay that can be considered as reinforced material to become composite cement. These cement eco-nano composites can provide new insights for the development of new 'environmental-friendly nanomaterials' for building applications such as the construction of sandwich panels, ceilings and roofs.

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Introduction

Myanmar has large amount of lakes, streams and rivers and many of these areas are deposited with soft clay. Kayah State has also many lakes and

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rivers. For future regional development, the clay samples were collected from Kan Khunit Sint lake, Demawso Township, Demawso, Kayah State. Kayah State (Fig.1), situated in southeast Myanmar, is bounded on the north by Shan State, on the east by Thailand's Mae Hong Son Province, and on the south and west by Kayin State as shown in Fig. 2. The area is 11,670 km^2 (4,510 sq mi). It is located about 2950ft above sea-level and hilly region. Demawso township, located in a valley is bounded by a highland regions. Kayah State has so many natural resources such as minerals, forests, water and soil for regional development.

Clay has soft, low strength and high compressibility characteristics. These are the major reasons of the design analysis which could be taken for any structure. So, the characterization of the clay was investigated and the advanced ceramics of nano-clay were examined with physical densities, porosity and absorbing water properties of reinforced composite materials. Better understanding and engineering of complex structure of cement based materials at nano-level will definitely result in a new generation of concrete, stronger and more durable, with desired stress-strain behavior and, possibly, with the whole range of newly introduced "smart" properties[1]. Going beyond the hellenic word *keramos* ("fired soil"), on the one hand, *ceramics* is defined as a name for products made out of non-metallic inorganic substances, and on the other hand, *ceramics* is defined as the art and science of making materials and products of non-metallic inorganic substances. Silicates clay products, cement and silicate glasses etc., are traditional ceramics. However, advanced ceramics meets the highest demands of present technologies. For instance, many advanced ceramic materials are

extremely resistant against abrasion, heat and also have further constraint properties such as temperature and pressure. Ceramic materials can be insulators, conductors, and semi-conductors.

Recently, nanoparticles are used in polymer, ceramic and construction materials, particularly producing nanocomposites which have superior physical and mechanical properties [2]. In the construction industry, several types of nanoparticles have been incorporated into concretes such as nano-SiO_2, nano-Al_2O_3, nano-Fe_2O_3, nano-ZnO_2, nano-$CaCO_3$, nano-TiO_2, carbon nanotubes and nano-metakaolin in order to improve the durability and mechanical properties of concrete [3–6]. In this work, structure analysis and material compositions of clay was investigated by EDXRF and powder X-ray diffraction.

Fig. 1 Satellite image of Kan Khunit Sint Lake, Demawso Township, Kayah State

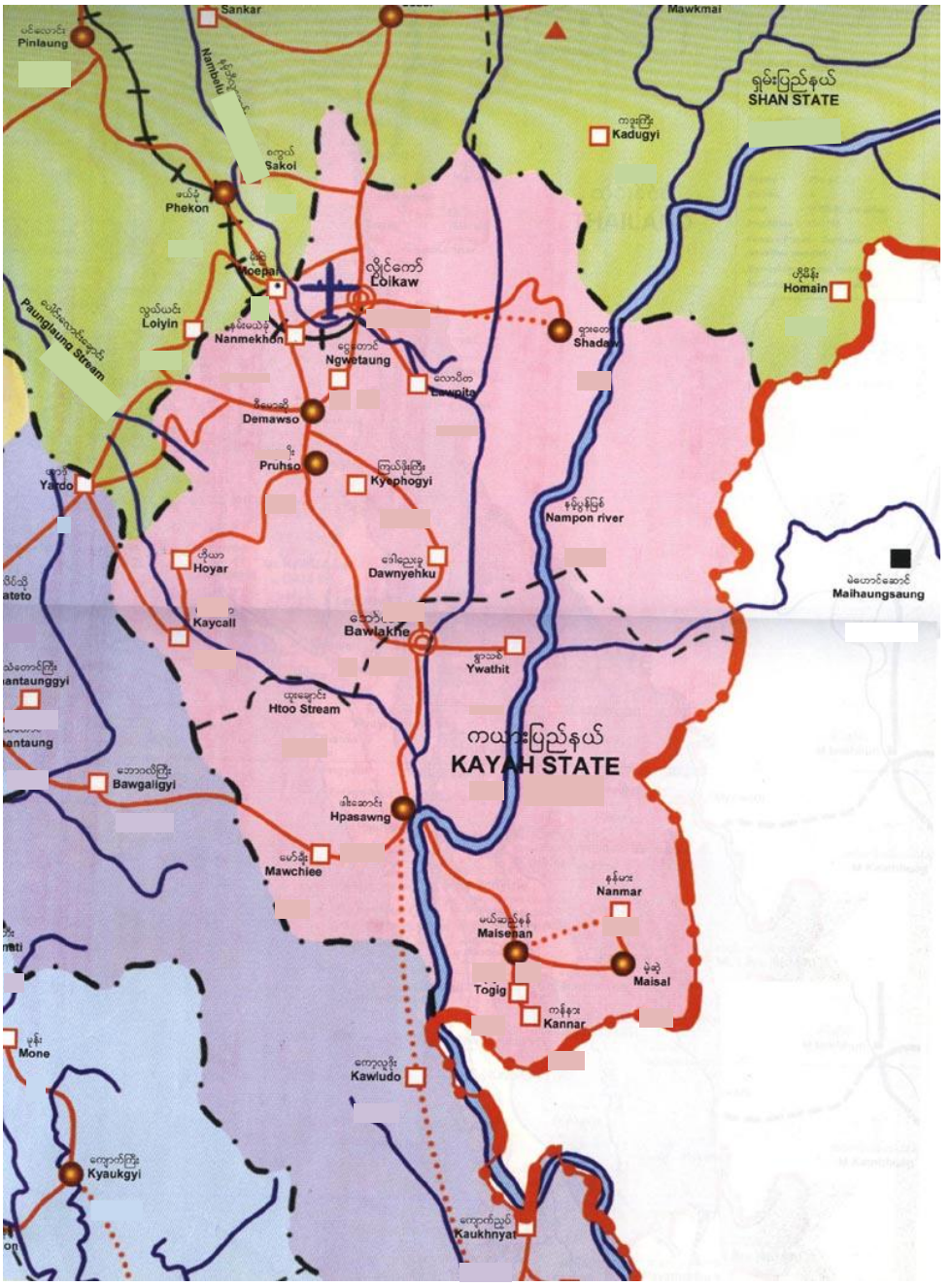


Fig.2 Location Map of Kayah State

Experimental Procedure

(a) Sample Collection and Preparation

Firstly, the soft clay samples were collected under 2 feet depth of water from the fourth step of Kan Khunit Sint lake, Demawso Township. It is 12 miles far from the Loikaw City, Kayah State. That lake is very pleasant and one of the historical places of Kayah State (Fig. 3).

Secondly, it was made the pellets to dry under the sun at 32°C for 5 hrs followed by three days (Fig. 4 and Fig. 5). Thirdly, after well dried, the sample was ground by the blander. The powdered clay was then filtered with filter cloth to get the homogeneous powder clay samples.

Fig.3 Kan khunit Sint lake, Demawso township, Kayah State

Finally, structure analysis of clay powder samples were performed by RIGAKU, MULTIFLEX X-ray diffractometer using Ni-filter with CuK_{α} radiation, using a wavelength λ = 1.54056 Å located at Universities' Research Centre (URC), University of Yangon. The angle range 2θ was observed 10°-70°. The relatives abundances of the phase formed were analyzed using JCPDS (Joint Committee on Powder Diffraction Standards). Lattice parameters of sample has been examined (Table 1).

Fig. 4 The clay sample from Kan Khunit Sint lake, Demawso township, Kayah State

(b)Energy Dispersive X-ray Fluorescence (EDXRF) Analysis

The dried clay powders was investigated by EDXRF analysis to analyze the composition of materials and to approach which properties of the clay may be applied.

(c) X-ray Diffraction (XRD) Analysis

Material characterization is an essential to understand the nature of things. It is required that technique selection must be matched to form of the sample and physical basis of the analytical probe.

(a) (b)

Fig. 5 (a) and (b) The pellets of dried clay

X-ray diffraction (XRD) is a powerful technique. It is the most widely used for the identification of unknown crystalline materials (e.g., minerals, inorganic compounds). Other applications are the characterization of crystalline material, identification of fine-grained materials such as clays and mixed layer clays that are difficult to determine optically, determination of unit cell dimensions and measurement of sample purity.

The study of solids is a rich scientific area, which depends on a great variety of experimental probes. Techniques using electromagnetic radiation are among the most fruitful of these. The very short wavelengths of X-rays are instrumental, even essential, in examining the atomic lattices that define crystalline solids [7].

Results and Discussion

Fig. 6 shows the existence of an outer surface quantitative chemistry elements Si, Fe, Ca, K, Ti, Mn, and Zr of clay samples by EDXRF and the chats show the highest composition element Si(42%) clearly in (Fig.7). According to first preliminary test for clay samples from Demawso, Kayah State, XRD results show the highest of element composition of Si (42wt%) when its supersaturated state is reached as in during air-oxidation, the Si element out to form SiO_2 (Tridymite) at about room temperature (Fig. 8). All of the XRD data of diffraction angle (2θ), atomic spacing (d), intensity (I) and miller indices (hkl) are listed in Table 1. The obtained XRD data are mostly agreed with standard data of JCPDS. The diffraction line of (011) plane at 26.723° is found to be strongest one.

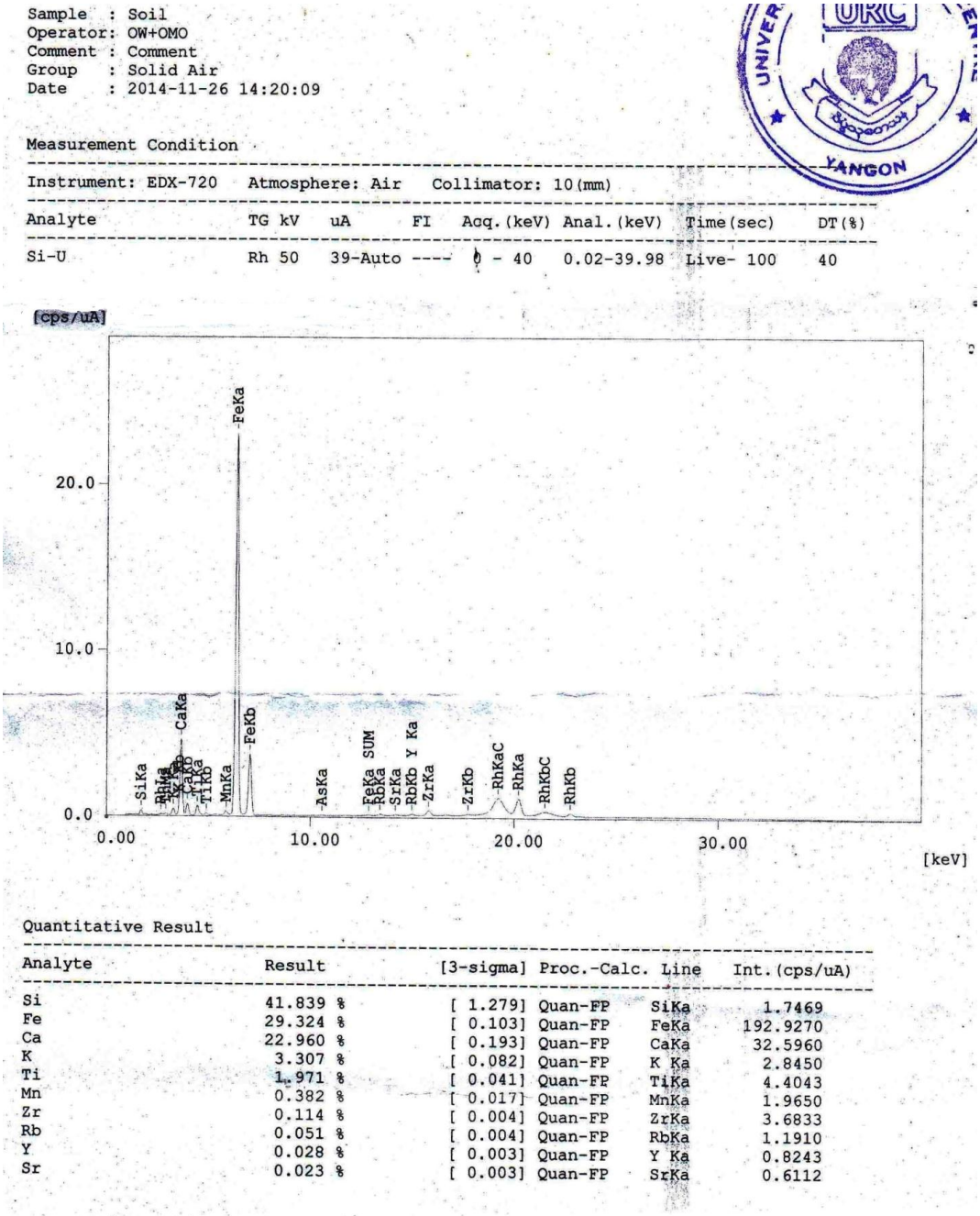
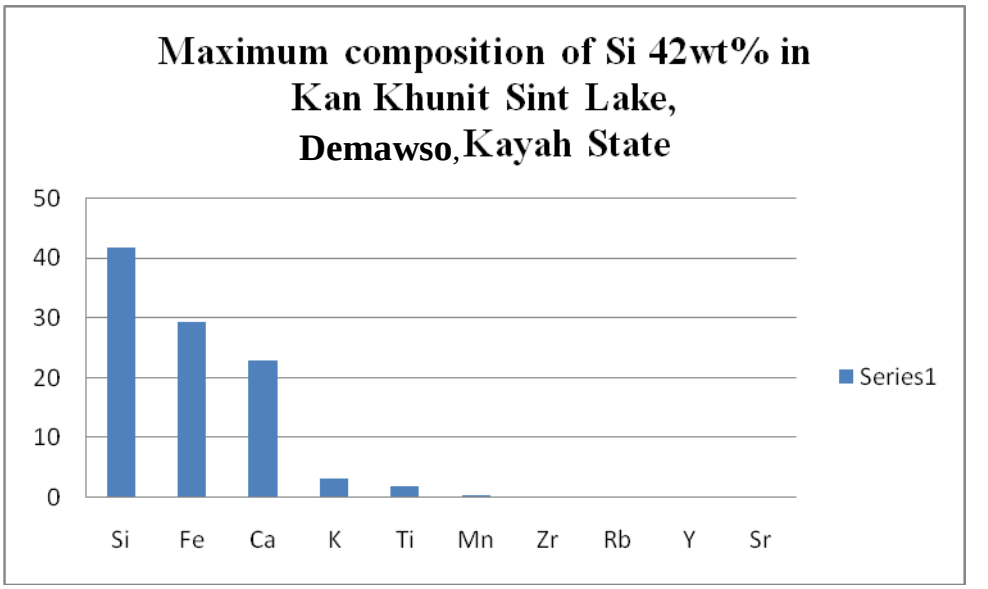
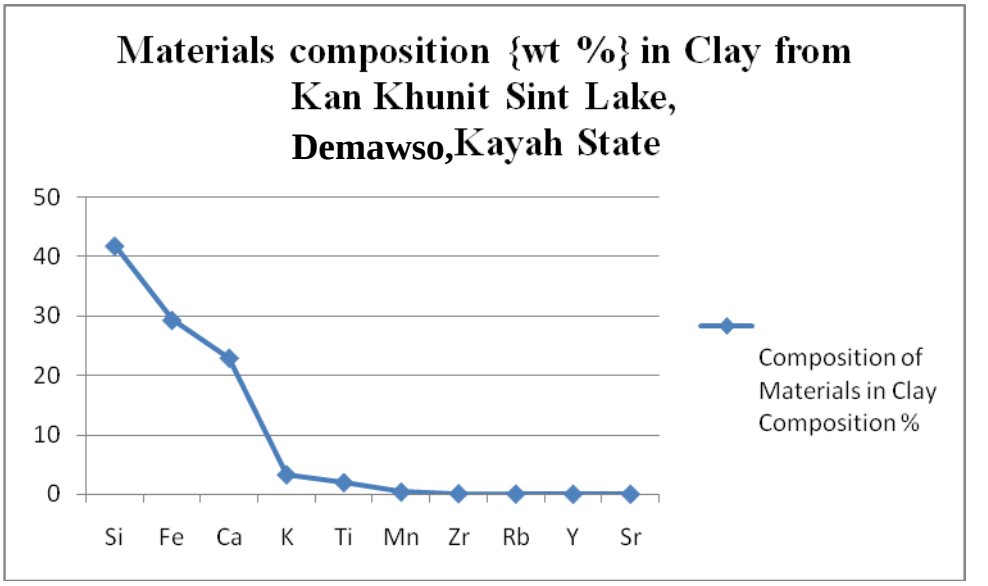


Fig. 6 The EDXRF pattern of the Clay sample from the Kan Khunit Sint lake, Kayah State



(a)



(b)

Fig. 7 (a) and (b) The Chart of the Composition of the Clay sample from the Kan Khunit Sint lake, Demawso, Kayah State

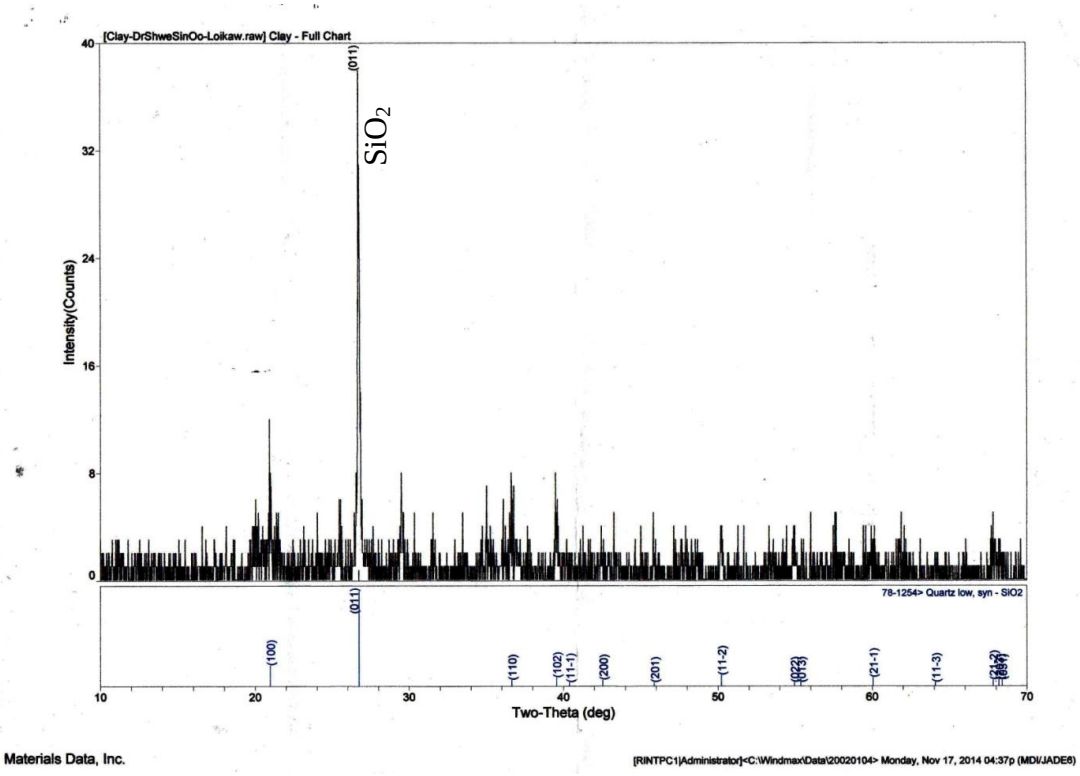


Fig 8 XRD pattern of the Clay from Kan Khunit Sint lake, Demawso, Kayah State

Table 1 XRD data of the Clay from Kan Khunit Sint lake, Demawso, Kayah State

Line No	Phase formed	2θ (°)	(hkl)	*d* (Å)	I (%)	Nanosize
1	SiO_2	26.723	(011)	3.3332	100	71

Conclusion

Clay powder samples were investigated by EDXRF and XRD analysis to approach the advanced ceramics of nano clay reinforced composite cement as a relatively new eco-friendly binder material in improving the strength characteristics of clay. According to experimental results, clay may be considered as nano-clay (~71nm) potential advanced ceramic materials. Some potential Advanced Ceramics are Al_2O_3, SiO_2, TiC, SiC, TiO_2, Al_2TiO_5, Ti_3SiC_2 and Ti_3AlC_2. Potential applications include structural laminate, sandwich panels, ceilings, roofing sheets, on-ground floors and concrete tiles. It can also be considered as a reinforced composite cement based materials at the nanolevel will apparently results in a new generation of concrete, stronger and more durable, with desired stress-strain behavior and, possibly, with the range of newly introduced properties, such as electrical conductivity, temperature-,moisture-, stress- sensing abilities. At the same time, this new concrete should be sustainable, cost and energy effective – in essence exhibiting the qualities modern society demands. The above statements are all really essential need for the regional development for the Higher Education and Science and Technology for the Kayah State.

Future recommendations for Regional Development

Future work, we have to find the potential advanced nano clay ceramics form Kan Khunit Sint lake and wherever of Kayah State for regional development. Then, we have to consider and fabricate with hemp fabric (Fig 9) (2) to become reinforced nanocomposites cement . This hemp fibre reinforced cement eco-nanocomposite could be an interesting alternative to conventional polymeric fibre reinforced cementitious composites in the

construction industry such as potential applications including structural laminate, sandwich panels, ceilings, roofing sheets, on-ground floors and concrete tiles.

(a) (b)

Fig 9. (a) and (b) the sample photos for Hemp fabric (2)

Acknowledgements

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