بسم الله الرحمن الرحيم

MONA MAGHRABY

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

MONA MAGHRABY

شبكة المعلومات الجامعية

التوثيق الإلكتروني والميكروفيلم

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

MONA MAGHRABY

AIN SHAMS UNIVERSITY

GEOLOGY DEPARTMENT
FACULTY OF SCIENCE

Utilization of some Egyptian Raw Materials in Glass and Rock Wool Industry

A Thesis Submitted to
Geology Department, Faculty of Science,
Ain Shams University, Cairo, Egypt.

For the Degree of Doctor of Philosophy for Science in Geology.

By
Mohamed Farouk Hassan Saied
(B.Sc. in Geology, 2008,
M.Sc. in Geology, 2016).

Supervised by

Prof. Dr. **Ali Farrag Sayed Osman**
Professor of Geology- Faculty of Science,
Ain Shams University.

Prof. Dr. **Ahmed Mohamed Abdel Aziz El-Kammar**
Professor of Geology- Faculty of Science,
Cairo University.

Prof. Dr. **Esmat Mahmoud Ali Hamzawy**
Glass Research Department,
National Research Centre, Dokki, Cairo

Prof. Dr. **Abdel Monem Mohamed Soltan**
Professor of Geology- Faculty of Science,
Ain Shams University.

Cairo
2020

AIN SHAMS UNIVERSITY

GEOLOGY DEPARTMENT
FACULTY OF SCIENCE

APPROVAL SHEET

Utilization of some Egyptian Raw Materials in Glass and Rock Wool Industry

A Thesis Submitted

For the Degree of Doctor of Philosophy for Science in Geology.

To Geology Department, Faculty of Science,
Ain Shams University, Cairo, Egypt.

By

Mohamed Farouk Hassan Saied
(B.Sc. in Geology, 2008,
M.Sc. in Geology, 2016).

Advisor	Approvd
Prof. Dr. **Ali Farrag Sayed Osman** Professor of Geology- Faculty of Science, Ain Shams University.	.....
Prof. Dr. **Ahmed Mohamed Abdel Aziz El-Kammar** Professor of Geology- Faculty of Science, Cairo University.	.....
Prof. Dr. **Esmat Mahmoud Ali Hamzawy** Glass Research Department, National Research Centre, Dokki, Cairo	.....
Prof. Dr. **Abdel Monem Mohamed Soltan** Professor of Geology- Faculty of Science, Ain Shams University.	.....

.....

Dr. Karim W. Abdelmalik
Head of Geology Department

2020

AIN SHAMS UNIVERSITY

GEOLOGY DEPARTMENT
FACULTY OF SCIENCE

QUALIFICATION

Name: Mohamed Farouk Hassan Saied

Degree: Doctor of Philosophy for Science in Geology.

Department: Geology.

Faculty: Science.

University: Ain Shams.

Year of graduate: B.Sc., in Geology, 2008
M.Sc in Geology, 2016.

Recent job: Quality Manager at GlassRock Insulation Company.

AIN SHAMS UNIVERSITY

GEOLOGY DEPARTMENT
FACULTY OF SCIENCE

Utilization of some Egyptian Raw Materials in Glass and Rock Wool Industry

By
Mohamed Farouk Hassan Saied
(B.Sc. in Geology, 2008
M.Sc. in Geology, 2016).
Geology Department, Faculty of Science,
Ain Shams University, Cairo, Egypt.

A thesis submitted for
The Degree of Doctor of Philosophy in Geology.

UNDER THE SUPERVISION OF

Prof. Dr.
Ali Farrag Sayed Osman
Professor of Geology,
Ain Shams University.

Prof. Dr.
Ahmed Mohamed Abdel Aziz El-Kammar
Professor of Geology,
Cairo University.

Prof. Dr.
Esmat Mahmoud Ali Hamzawy
Glass Research Department,
National Research Centre, Dokki, Cairo

Prof. Dr.
Abdel Monem Mohamed Soltan
Professor of Geology,
Ain Shams University.

Cairo
2020


ABSTRACT

ABSTRACT

In Egypt, tremendous unexploited raw materials could assist much in the technology of glass and rock wool industry. Paleozoic Formations in Egypt include rock units dominated by different quality silica sand which is considered the primary source for glass industry. The silica sand is mainly belonging to the Naqus and Abu Thora Formations of Cambro-Ordovician and Lower Carboniferous ages in Wadi El Dakhal and Um Bogma areas respectively.

The dolomite is extended along the escarpment of Maghra El-Bahari Formation at Gabal Ataqa, Suez area and is possibly belonging to the Late Cretaceous to Early-Middle Eocene.

The limestones of Middle Eocene outcrops in Samalut, Minia governorate, represent a huge reserve that can supply different industries. Meanwhile, the feldspar and kaolin occurrences are widely distributed along the southern Sinai localities as well as the Pre-Cambrian rocks of Um Bogma region and its frontier. On the other hand, the Cenozoic basalt rocks are widely outcropping in three localities in Egypt (Abu-Zaabal, El-Fayoum and Baharyia). The previous mentioned raw materials have not effectively adopted in glass and rock wool insulation material industry in Egypt. Although they are considered the main sources for SiO_2, MgO, CaO, Na_2O, Al_2O_3 and Fe_2O_3 which represent the main formula for the glass and rock wool batches.

In the time of increasing the cost of energy, it becomes a demand to use different grades of cost-effective raw materials to be used in glass and rock wool batches. The main aim of this work is to process glass and rock wool boards with optimum thermal, acoustic and fire resistance together with mechanical properties. The optimum use of these cheap and overlooked raw materials will

eventually reduce the cost of glass and rock wool batches and produce well-matched quality commodities.

To achieve this goal, different glass and rock raw material samples have been collected, characterized and processed in the cold top electric and Cupola industrial furnaces respectively, with a consequently detailed study of the boards end-products. The starting raw material, molten “cinders” and wool boards have been characterized using XRD, XRF, SEM-EDAX, Stereomicroscopy, Lambda meter, mechanical testing and other ASTM and EN standard measuring procedures.

The CaO/MgO ratio, and other calculated viscosity moduli i.e. acidity, basicity and melting capability of the studied raw materials and their derivative cinders encourage their effortless consistent melting at lower energy with the high fiberizing ability and fiber quality.

Based on the melting tests, the optimum moduli in molten glass are mainly related to the least remnant light minerals i.e. quartz, albite and dolomite as well as heavy minerals embodied in these raw materials i.e. zircon, corundum and garnet which eventually facilitates the molten glass flowability and fiberization. The lower the remnant non-melted dense minerals in the glassy melt, the higher is the melted consistency, fiberization ability and the best is the fibers quality as well. Whereas, the lower the mafic, i.e., the Mg-bearing minerals, and the maximum the plagioclases, i.e., the Ca-bearing minerals, of the raw basalt rocks, the optimum is the cinder characteristics for fiber production.

The prepared rock wool fibers from basalts attained quasi-horizontal dominating macrostructure style; diameter and the non-fibrous amorphous