ABSTRACT

The microstructure of the radiation effect of the heat on the complete cable NYM

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Cable NYM 3 x 2.5 mm^2 is widely used in the fields of engineering applications , especially as a conductor of electrical power components that will be used on the equipment. Have a standard mechanical properties and electrical properties . Mechanical properties such as tensile test to see the characteristics of the material , as well as the required electrical properties such as resistivity and conductivity test to determine the ability to deliver power . At the field of engineering applications is necessary so to do research on the mechanical and electrical properties of the cable intact with heat treatment that is meant to simulate real fire . In this study, given the heat treatment temperature of 100ºC , 120ºC , 150ºC , 180ºC , 200ºC and air cooling , sand , soapy water , rain water , a mixture of everything , tensile testing , photos microstructure and resistivity test material . The test results is the mechanical properties of wires with different heat treatments have values of tensile strength and resistivity of different materials on each test specimen . From the graph looks the greater the temperature of heating and cooling is slow , the resistance of the cables NYM 3 x 2.5 mm^2 is increasing. Based on the literature that the standard strain (20-40 %) , modulus of elasticity (1.2-3.3 MPa) , and tensile strength standard (7-12.5 MPa) then the cables can still be used for the installation of heating only to 180ºC. Because the temperature of 200ºC not meet the standard strain (20-40) and modulus of elasticity (1.2-3.3 MPa) , although standards tensile strength (7-12.5 MPa)

Keywords : Cables , resistivity , characteristics of the microstructure

INTRODUCTION

In the building of electrical installation systems , electrical appliance , and mechatronic systems , electrical wiring is one vital component that serves as a conductor of electric current from the electricity source . [1] . In the residential electrical installations , there are at least three types of electric wires is the most commonly used type of cable NYA , NYM and NYY . The term NYA , NYM and NYY a nomenclature or the nomenclature on the cable. [2] . PUIL 2000 (General Requirements for Electrical Installations in 2000) in the Annex C explains the nomenclature (nomenclature) of this cable . From the attachment, the cable NYA , NYM and NYY means berpenghantar standard copper cabling (the letter " N ") and sheathed insulation of PVC (Poly Vinyl chlorid) (the letter " Y ") . [ ]

METHODOLOGY

The tests to be done is to re-examine the characteristics of cables that had been burned in buildings , ie NYM cables that meet applicable standards , whether it can be reused after the cable exposed to the effects of heat radiation , when compared with cable testing parameters before burning .
The purpose of this study to determine the extent of reuse of completed cable NYM after suffering the effects of heat radiation on a cable installation or not by comparing the testing parameters by standard literature national cable .
Boundary problem in this paper is to compare the characteristics of the mechanical testing , testing electrical and characteristic analysis microstructure complete cable NYM , both wired before exposed

to the effects of radiation with complete cable NYM thereafter at a temperature : 100ºC , 120ºC , 150ºC , 180ºC and 200ºC for 2 hours (120 minutes) .

RESULT

The maximum voltage is obtained from the quotient of the maximum load value received by the time of testing material to the surface area , which in this phase deformation continues to occur while the load decreases slowly .

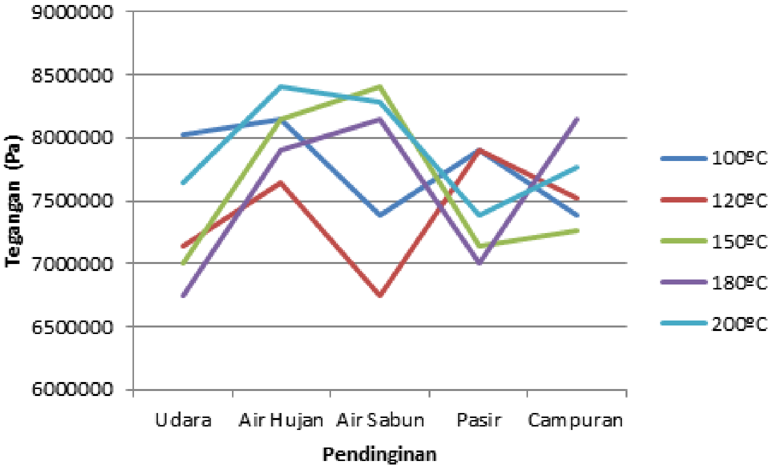
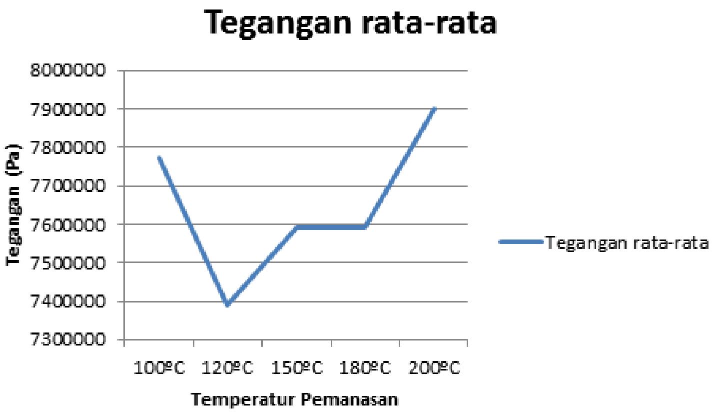


Figure 4.1 Graph Rated Voltage Vs Cooling

Graph maximum voltage value average based on different heating temperatures can be seen in Figure 4.2



Broken voltage is where the value of the voltage that caused the fracture in the specimen . Graph fracture stress value with each cooling and heating temperature can be seen in Figure 4.3 .

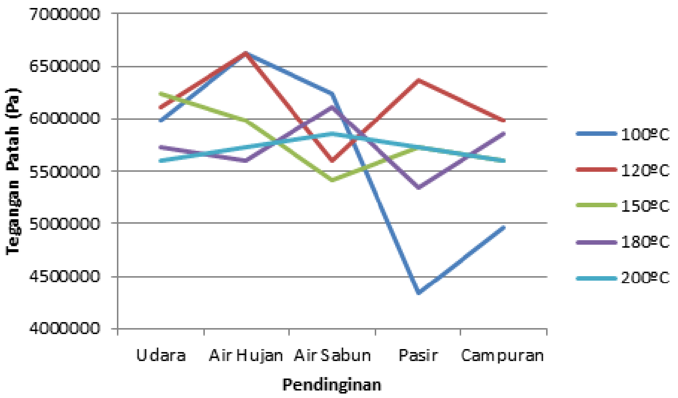


Figure 4.3 Graph Rated Voltage Vs Broken Refrigeration

Graph fracture stress value average based on different heating temperatures can be seen in Figure 4.4

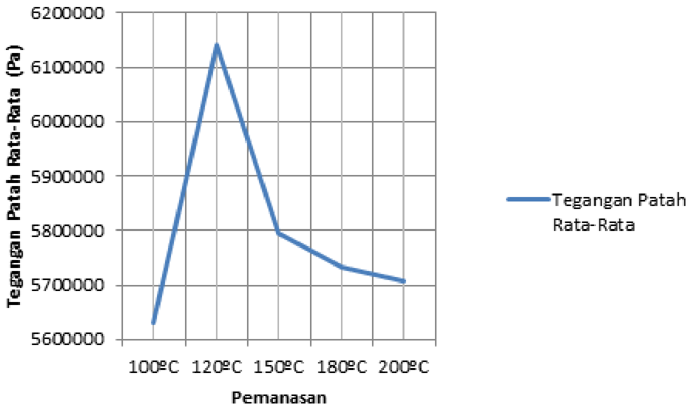


Figure 4.4 Graph Rated Voltage Broken Average Vs Temperature Heating

Stiffness of a material is expressed by the Modulus of Elasticity (E) as Figure 4.5 Modulus of Elasticity Vs Cooling is the greater the value of modulus of elasticity , the more rigid the material well.

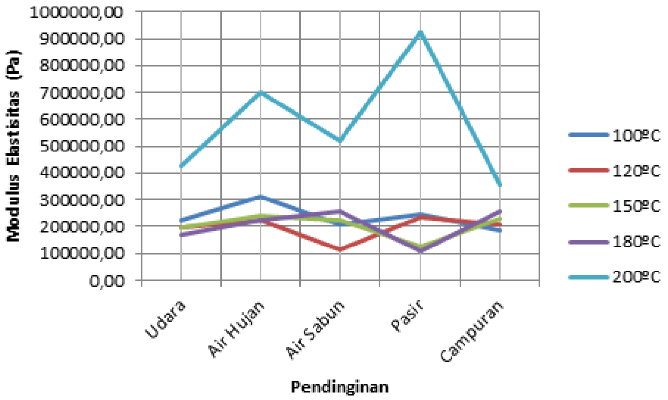


Figure 4.5 Modulus of Elasticity Vs Cooling

Graph elastic modulus average based on different heating temperatures can be seen in Figure 4.5. Seen at a temperature of 180^0C , the modulus of elasticity increases.

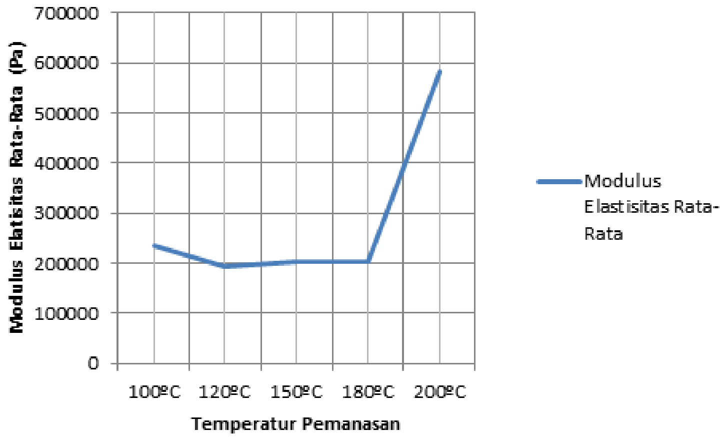


Figure 4.5.Modulus of Elasticity Average Vs Temperature Heating

Test microstructure on testing is done using SEM (Scanning Electron Microscopic) , performed with 1000X magnification for the specimen intact cables already in the tensile test and experience of each cooling after being exposed to heat radiation effect on each of the heating temperature . Below can be seen the results of testing in the form of images of the microstructure of copper wire cable as a comparison of normal and test specimens were cooled rainwater with magnification of 500 times on each of the heating temperature .

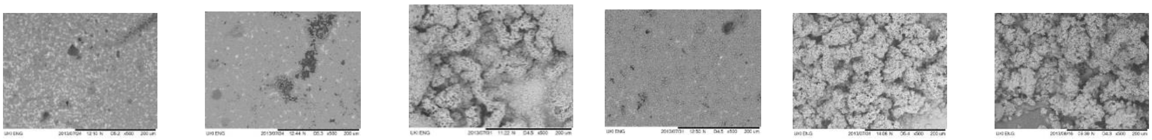


Figure 4.6 microstructure Copper Wire Cables Whole with Rain Water Cooling .
(A) heating of 100 ° C , (b) heating of 120 ° C , (c) heating of 150 ° C , (d) heating to 180 ° C , (e) heating to 200 ° C , (f) Normal Cable .

Below can be seen the results of testing in the form of images of the microstructure of copper wire cable as a comparison of normal and test specimens were cooled mixture with a magnification of 500 times on each of the heating temperature .

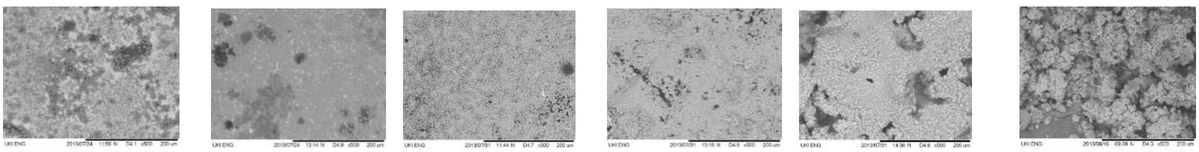


Figure 4.7 Structure of Copper Wire Micro Cables Whole By cooling the mixture .
(A) heating of 100 ° C , (b) heating of 120 ° C , (c) heating of 150 ° C , (d) heating to 180 ° C , (e) heating to 200 ° C , (f) Normal Cable .

Below can be seen the results of testing in the form of images of the microstructure of copper wire cable as a comparison of normal and test specimens which cools the sand with a magnification of 500 times on each of the heating temperature .

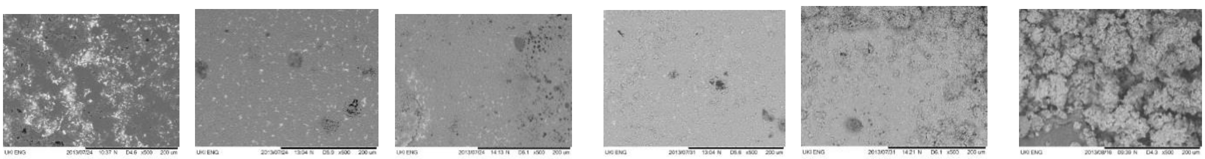


Figure 4.29. Structure of Copper Wire Micro Cables Whole With Sand cooling .
(A) heating of 100 ° C , (b) heating of 120 ° C , (c) heating of 150 ° C , (d) heating to 180 ° C , (e) heating to 200 ° C , (f) Normal Cable .

Below can be seen the results of testing in the form of images of the microstructure of copper wire cable as a comparison of normal and test specimens are cooled soapy water with magnification of 500 times on each of the heating temperature .

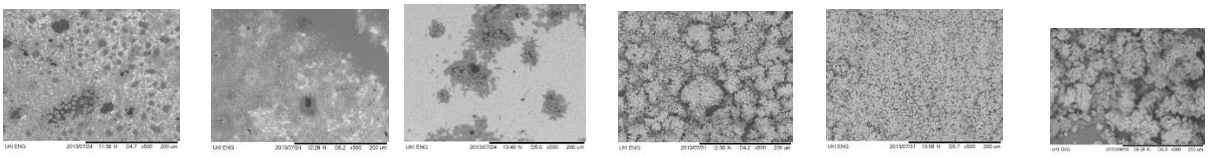


Figure 4.30 Structure of Copper Wire Micro Cables Whole Cooling Water With Soap .
(A) heating of 100 ° C , (b) heating of 120 ° C , (c) heating of 150 ° C , (d) heating to 180 ° C , (e) heating to 200 ° C , (f) Normal Cable .

Below can be seen the results of testing in the form of images of the microstructure of copper wire cable as a comparison of normal and test specimens which cools the air with magnification of 500 times on each of the heating temperature .

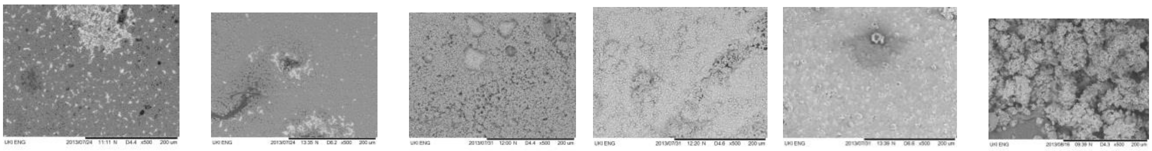


Figure 4:31 microstructure Intact With Copper Wire Cable 500X Magnification And Cooling Air .
(
A) heating of 100 ° C , (b) heating of 120 ° C , (c) heating of 150 ° C , (d) heating to 180 ° C , (e) heating to 200 ° C , (f) Normal Cable .

Below can be seen the results of testing in the form of images of the microstructure of copper wire cable as a comparison of normal and test specimens were cooled rainwater with magnification of 1000 times on each of the heating temperature .

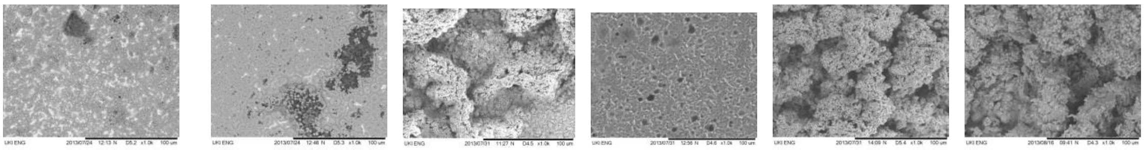


Figure 4.32 Structure of Copper Wire Micro Cables Whole With magnification of 1000X And Rain Water Cooling .
(A) heating of 100 ° C , (b) heating of 120 ° C , (c) heating of 150 ° C , (d) heating to 180 ° C , (e) heating to 200 ° C , (f) Normal Cable .

Below can be seen the results of testing in the form of images of the microstructure of copper wire cable as a comparison of normal and test specimens were cooled mixture with magnification of 1000 times on each of the heating temperature .

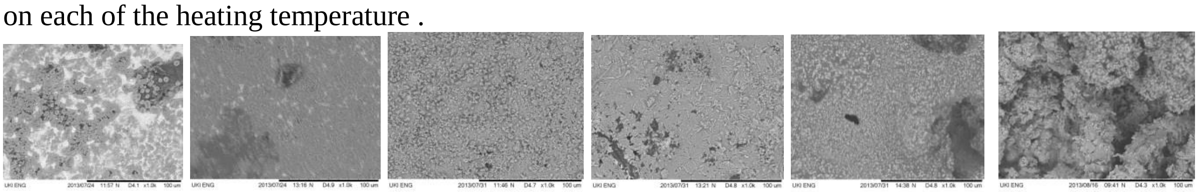


Figure 4:33 microstructure Copper Wire Cable Intact With magnification of 1000X And Cooling mixture
(A) heating of 100 ° C , (b) heating of 120 ° C , (c) heating of 150 ° C , (d) heating to 180 ° C , (e) heating to 200 ° C , (f) Normal Cable .

Below can be seen the results of testing in the form of images of the microstructure of copper wire cable as a comparison of normal and test specimens were cooled sand with magnification of 1000 times on each of the heating temperature .

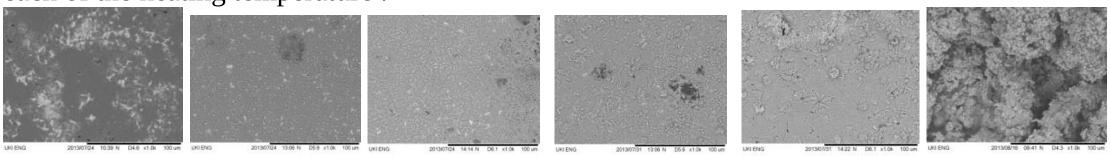


Figure 4.34 Structure of Copper Wire Micro Cables Whole With magnification of 1000X And Cooling Sand.
(A) heating of 100 ° C , (b) heating of 120 ° C , (c) heating of 150 ° C , (d) heating to 180 ° C , (e) heating to 200 ° C , (f) Normal Cable .

Below can be seen the results of testing in the form of images of the microstructure of copper wire cable as a comparison of normal and test specimens are cooled soapy water with magnification of 1000 times on each of the heating temperature .

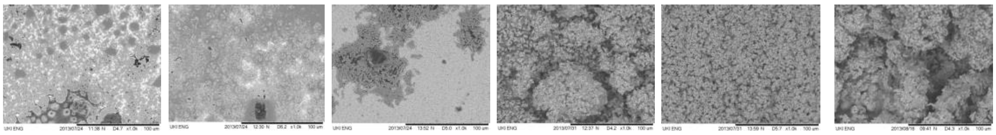


Figure 4:35 microstructure Copper Wire Cable Intact With magnification of 1000X And Cooling Water Soap.
(A) heating of 100 ° C , (b) heating of 120 ° C , (c) heating of 150 ° C , (d) heating to 180 ° C , (e) heating to 200 ° C , (f) Normal Cable .

Below can be seen the results of testing in the form of images of the microstructure of copper wire cable as a comparison of normal and test specimens which cools the air with magnification of 1000 times on each of the heating temperature .

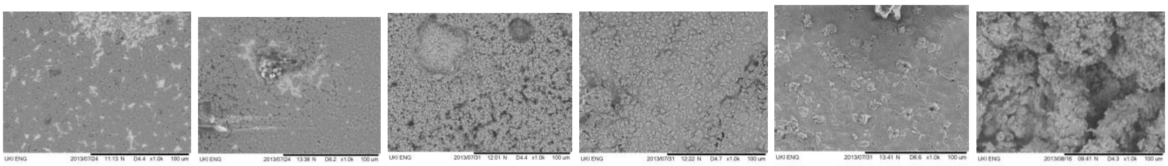


Figure 4:36 microstructure Copper Wire Cable Intact With magnification of 1000X And Cooling Air .
(A) heating of 100 ° C , (b) heating of 120 ° C , (c) heating of 150 ° C , (d) heating to 180 ° C , (e) heating to 200 ° C , (f) Normal Cable .

Conclusion

1. The temperature of the heating and cooling methods affect the value of tensile strength and hardness of cables NYM 3 x 2.5 mm^2 . Violence and its strength drops when the temperature hotter and faster cooling .
2. From the graph looks the greater the temperature of heating and cooling is slow , the resistance of the cables NYM 3 x 2.5 mm^2 is increasing.
3. Characteristics of cables NYM 3 x 2.5 mm2 meet the standard for Literature to become the cable installation in buildings , referring to the above test results , until the heating temperature 180ºC . Because the temperature of 200ºC does not meet the standard strain (20-40 %) and modulus of elasticity (1.2-3.3 MPa) , although standards tensile strength (7-12.5 MPa)

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