APPLICATION OF (CLAY) RAW MATERIALS IN ENGINEERING

Manyuchi Kingstone
Supervisor - Ph.D. Rybalko I.
Kharkov Petro Vasylenko National Technical University of Agriculture
(61050, Kharkov, 45, Moskovsky Avenue, Dep. of technological systems repair production, tel. (057) 732-73-28) E-mail: kafedraTSRP@i.ua; fax (057) 700-38-88)

In recent years interests in engineering of clay (bentonite, kaolinite, montmorillonite, etc.) fossils has gained particular importance. What caused this? It is known that alumina(clay) is a mixture of various oxides which are mainly SiO_2 (silicon dioxide) and Al_2O_3 (aluminium oxide) not forgetting many finely dispersed impurities of various metals such as iron, titanium, manganese, calcium, sodium and less often chromium, zirconium, molybdenum, vanadium. This material (clay) is easily accessible, most importantly it has a number of properties that we are able to change. Advancements in future can allow us to set the parameters of this material depending on technical requirements and tasks. It is also known that changing the characteristics of clays can be achieved by various methods for example varying the heat treatment modes, switching to various metal and non-metal modifiers, applying them to surfaces, etc. In addition, clay can adsorb impurities of organic and inorganic origin. These materials (clay) are not scarce and are cheap in comparison with activated carbons. More over they can be modified thereby increasing their absorption capacity. A reliable way to protect metals from oxidation at high temperatures is by the use of heat-resistant coatings like refractory oxides, silicates and other inorganic compounds. Protective coating compositions are used which consist of silicate, aluminosilicate, boor-aluminosilicate glasses and refractory fillers and are used as powders of aluminium, corundum, Cr_2O_3, TiO_2, zircon, bar-oxides, carbides, iron, aluminium, silicon, etc. The introduction of finely divided metal powders lead to the binding of oxygen penetrating through the coating due to the formation of the corresponding oxides.

Despite all of the above advantages clay in mechanical engineering has not yet found a wide application. Therefore, the discovery and implementation of new technologies based on the use of clay will become a priority. Clay will provide an additional base of innovations and research for the coming years. Wear of mechanical parts is the most common problem in non-electronics. Close attention is paid to abrasive wear given its high occurance and damage.

There are different ways to solve this problem like improving the quality of the material surface by auxiliary coating, nitriding, cementation, nitro- mentation, condensation with ion bombardment, galvanic coatings and many others. However, these methods require expensive equipment and materials not forgetting that these are sophisticated technological methods for an ordinary farmer/tradesman. Our approach is to reduce the cost and increase the resourcefulness of soil tilling machines using easily available tools and machine technologies. Electric arc welding was selected as the technological operation. hot electrodes, loam and clay were used as the alloying materials. These materials (clay) are available in large numbers from different fields. Initially the clay samples were air dried, then ground in a ball mill to fine powder (1-5microns) for 40 minutes. Then pressed in a special stamp for chemical analysis into tablet form (d = 16mm). Samples of crushed clay were mixed with PVA glue in the proportion 1:1 by weight and the mixture was applied as a thin layer approximately 1.7g onto welding electrodes marked PATON VDI-200R. These modified electrodes were dried for 24 hours in open air and then in a thermal cabinet at 1200°C for 1,5 hours. When the electrodes dried, they were welded onto steel specimens (plates) by hand using an electric arc welder. We used two clay coated electrodes with clay samples from two different fields and an electrode without coating. Samples of the steel and cast iron were cut perpendicular to the axis of the welds and aligned on an abrasive emery. Then sent to a micro-X-spectral analysis, micro-hardness and wear resistance tests.

This technology increased wear resistance of the working bodies on soil cultivation machinery and all made possible through the use of natural materials (clay). These machines will save on spare parts in agriculture.