HOFFMANN MINERAL
Unternehmensgruppe Hoffmann

Neuburg Siliceous Earth

in welding rods

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1. What is Welding?

Welding is a metallurgical process in which metals are heated at a specific point to a predetermined temperature to produce fusion at that point. During this process metal oxides are formed as a result of a reaction with the oxygen in the air, which can cause occlusions. These represent a serious problem. Fluxes are used to prevent the formation of occlusions. They improve the fluidity of the metal, prevent oxides from becoming trapped in any joint where they could weaken it and they reduce the possibility of blow holes being caused by trapped gases. There is no universal flux which can be applied to all classes of metal - it is necessary to select the proper flux for each different type.

2. Methods of Welding

There are three major welding techniques:

- Gas metal arc welding (GMAW) with an oxygen-acetylene gas mix (the welding spot is blank, protection against oxidation does not exist)
- Flux-cored arc welding (FCAW) with stick electrodes (the flux agent in the electrode sheathing acts as protection against oxidation)
- Tungsten inert gas welding (TIGW) with cored wire electrodes (the shielding gas protects against oxidation, welding powder being partly inside the welding electrode)

3. Stick Electrodes

SILLITIN is mainly of interest in the stick electrodes used in the FCAW welding process. This type of welding is often used in the building and repair sector because the necessary welding equipment is relatively small and transportable. The following classification for stick electrodes is commonly in use:

- basic coated or lime-basic covered electrodes
- rutile electrodes
- acidic ore electrodes
- cellulose-covered electrodes

Neuburg Siliceous Earth (SILLITIN N 85 in particular, but also SILLITIN Z 86) is most frequently used in rutile electrodes.

4. Raw Materials for the production of rutile electrodes

The rod is made from alloyed or non-alloyed steel depending on the demands of the application. Most electrode sheathings are based on ceramic-like materials. The exact composition of the sheath, the thickness and the weight ratio between the sheath and wire are all important.

Firstly, the powdered materials for the sheath are dry mixed which is followed by mixing with water glass (sodium metasilicate) to a paste-like dough. This dough is then used for the production of the electrode sheathing using a special electrode press machine. Finally the sheathed electrodes are run through a drying process. Among the non-alloyed electrodes most have rutile sheaths, the most interesting type for the use of SILLITIN.

The non-basic titanium dioxide comes either from a synthetic process (the product is generally named as "titanium white") or much cheaper from a dark brownish mineral named "Rutile" which contains approx. 95% of titanium dioxide. This mineral is an excellent flux for making slag.

A strongly basic acting raw material is chalk. The decomposition products act as inert gas and flux for making slag.

A strongly acidic oxide is silica. It supports a rapid melting off into fine droplets and counteracts the heating-up of the electrode. As a rule, silica is used in the form of silicates such as clay, wollastonite, talc and others or as a mixture thereof. SILLITIN, being a natural silicate with an extraordinary natural fineness and uniformity in the particle size distribution, produces an optimal homogeneity of the electrode sheath.

Cellulose and other organic components act also as binding agents. They burn and thus create an inert atmosphere.

Ferromanganese is an iron manganese alloy acting mainly as a deoxidizing (reducing) agent.

5. Typical formulations for rutile electrodes

Formula no.	**1**	**2**	**3**	**4**	**5**
Weight in %					
Rutile	50	50	50	55	20
Chalk	2	15	5	10	5
Cellulose	8	2	15	5	-
SILLITIN	30	20	22	20	12
Ferromanganese	10	13	8	10	8
Iron Powder	-	-	-	-	55

6. Results

- Formulas no. 1 and no. 2 are especially for vertically welding upwards (overhead)
- Formula no. 3 is especially for vertically welding downwards
- Formula no. 4 shows good mechanical properties combined with easy weldability
- Formula no. 5 produces a high sheathing ratio resulting in a high welding yield.

In general, SILLITIN helps to provide a homogeneous sheathing. During welding, good slag flow with no dripping leads to flawlessly welded joints with good appearance.

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