

The invention relates to a process for the production of a green protective and covering layer on rolled copper strip or sheet for roof covering and façade cladding.

Under normal atmospheric influences, copper only forms a green to turquoise coloured protective layer, the so-called patina, on its surface after a relatively long time and also only in certain conditions. The speed of formation of this natural patina is dependent on the following parameters for example:

- composition of the atmosphere (moisture, level of impurities)
- exposure to solid particles (sand, dust)
- ambient temperature
- inclination of the surface of the copper parts
- position in relation to the prevailing weather direction

The publication of the German Copper Institute "Chemische Färbung von Kupfer und Kupferlegierungen" [Chemical Colouration of Copper and Copper Alloys] indicates the following times for the formation of a natural patina for the different atmospheric influences:

- approximately 6 years in sea air
- approximately 5 to 8 years in large city and industrial atmospheres
- approximately 8 to 12 years in normal town atmosphere.

The patina formed protects the copper part effectively against further weathering influences so that the rate of wear of the copper approaches the value zero when the patina reaches its maximum basicity. Therefore, it is also not surprising that practitioners were also quick to investigate and imitate this protective layer. Artificial green patination of artistic objects such as statues and vessels for example by means of the spotting method has already been known for a long time.

In addition, there are a number of patinating reaction solutions which can be applied to large areas such as roof coverings for example in a number of stages using spraying or brushing methods. DE-A-19 60 960 discloses a chemical process for forming a patina in which the surface of a copper sheet is first cleaned and then treated with a solution containing ammonium sulphate, mercury-II-chloride and copper sulphate.

The disadvantage of the processes known to date lies in the fact that they can only be applied manually or only used for limited areas and are therefore too uneconomical for large scale industrial production.

Lastly, another process is known in which patina-coloured plastic layers are applied to copper strips provided for roof covering and façade cladding. The drawback of this process is that the layers applied peel off very easily and then the self-healing mechanism of the natural patina is missing. It may be added that the necessary processing methods such as soldering or crimping have their limitations.

The underlying object of the invention is to disclose a process of the kind mentioned initially with which a green, firmly adhering covering layer very similar to the natural patina can be produced on the surface of semi-products made of copper on a large industrial scale.

This object is achieved according to the invention by the combination of the process measures named in claim 1. Advantageous variants of the invention are disclosed in the sub-claims.

The essential advantages of the process according to the invention are in particular that through the continuous production

- an extremely uniform preliminary treatment is obtained for all strips and panels; this is an important requirement for artificial green patination with a uniform colouration;
- variable production lengths are possible without cutting waste;
- no colour changes can occur at the ends of the strips or sheets;
- no abrasive belt failures occur due to raised strip or sheet ends;
- the abrasive belt for example can be operated systematically through strip centre or edge control.

It has also been demonstrated that the artificially green-patinated strips or sheets of copper manufactured by the process according to the invention exhibit protective layers with excellent adhesion. Even the finger marks frequently unavoidable when fitting roof coverings and façade claddings remain largely unnoticed on the green patinated surface.

In further tests it was discovered that the protective and covering layer applied acts as a catalyst for the gradually forming natural patina, i.e. the artificial protective layer changes into a natural patina in the course of time under atmospheric influences. Preferably the protective and covering layer consists of copper oxide (CuO) and an essentially copper-free metal salt. After aging, the weight per unit area of the completely reacted protective layer is 180 to 680 mg/dm^2 , preferably 330 to 525 mg/dm^2 .

The invention will be explained in further detail in the following with reference to an embodiment example.

A cold-rolled 1000 mm wide strip of SF copper to DIN 1787 with a thickness of 0.7 mm is first degreased in a continuous installation. Next, for systematic enlargement of the surface, by the factor 2 for example, the copper strip is first run through a belt sanding machine which is fitted with one or more abrasive belts of grit size 40 to 60 for example and possibly an additional brushing device. The installed strip centre or strip edge control ensures precise positioning of the copper strip in relation to the abrasive belt. After this, the copper strip then runs through a dual-roller frame the rollers of which preferably exhibit surfaces roughened or textured in the direction of the axis of the roller. In line the copper strip then runs through a spraying and squeezing machine in which the chemical reaction solution for producing the green patina is applied evenly to the surface. After application of the reaction solution, the copper strip is divided into production lengths according to the customer's requirements by a transverse cutter running with it. The copper strips or sheets coated on one side are separated individually in racks and the racks are then left to age in a conditioned room at a temperature of approximately 20°C and a relative air humidity of 70% for 6 to 48 hours. In order to accelerate the formation of the protective layer on the copper in the conditioned room, additionally either an electrical voltage can be applied or gaseous reaction media can be introduced. After the aging process the weight per unit area of the protective and

covering layer of a few test pieces was determined. On average it was approximately 430 mg/dm².

The bending and crimping operations required for use in the building sector were then carried out on the artificially green-patinated copper strip without damage or extensive peeling of the protective and covering layer occurring.



PATENT CLAIMS

1. Process for the production of a green protective and covering layer on rolled copper strip or sheet for roof covering and façade cladding, characterised by the combination of the following process steps:

- degreased copper strip is first roughened by means of a textured working roller to enlarge the surface by a factor of 1.1 to 5;
- the copper strip is then treated with a chemical reaction solution in a continuous process to produce a green patina, the weight per unit area of the coating lying between 180 and 680 mg/dm²;
- the chemically treated copper strip is then aged in an air-conditioned room.

2. Process for the production of a green protective and covering layer according to claim 1, characterised in that the layer on the copper strip consists of copper oxide and an essentially copper-free metal salt.

3. Process for the production of a green protective and covering layer according to claim 1 or 2, characterised in that the weight per unit area of the coating is 330 to 525 mg/dm².

4. Process for the production of a green protective and covering layer according to one of claims 1 to 3, characterised in that the chemically treated copper strip is aged at a temperature lying in the range between 15 and 35°C and an air humidity between 70 and 100%.

5. Process for the production of a green protective and covering layer according to one of claims 1 to 4, characterised in that the aging of the chemically treated copper strip is accelerated by applying a voltage or by adding gaseous reaction means.

6. Process for the production of a green protective and covering layer according to one of claims 1 to 5, characterised in that the copper strip is continuously cut transversely to the required lengths after the mechanical treatment step or after the application of the chemical reaction solution.