POLITECHNIKA ŚLĄSKA
WYDZIAŁ INŻYNIERII MATERIAŁOWEJ

ROZPRAWA DOKTORSKA

mgr inż. Beata Cwolek

Technologiczne aspekty wytwarzania i przetwarzania nowych ekologicznych stopów armaturowych

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Summary

Doctoral dissertation entitled:

Technological aspects of production and processing of new ecological fittings alloys

The dissertation, guided by the requirements of Drinking Water Directive 2020/2184/EU (DWD), focused on the strategy for selecting chemical compositions and developing the technological basis for the production and working by the hot forging process of new ecological brass intended for water meter bodies and other elements in contact with drinking water. The focus was on designing two groups of materials. The first one was low-lead CuZnPb alloys, with a Pb content below 1,2 % Pb and a zinc content ranging from 38 to 38,5, and the second one - a low-lead CuZnPb alloy (so-called DZR - dezincification resistant) with a lead content below 1,2 % and zinc content approx. 34 %, with additions of elements modifying the morphology of the microstructure and changing technical and technological characteristics.

Range of chemical composition of the alloys complying with the foundry requirements, susceptibility to plastic working, machinability and corrosion resistance was determined.

The chemical composition of the alloys and process assumptions were developed, and the alloys were produced in laboratory conditions by melting and casting. The produced material was subjected to structure testing, assessment of mechanical properties and susceptibility to plastic working. The obtained results allowed the conclusion that the developed material can be the basis for work in semi-industrial conditions. This work was preceded by carrying out numerical simulations, the aim of which was to check the correctness of the adopted technological assumptions. Verification, by means of numerical simulation, of the correctness of the adopted assumptions allowed for further work related to the production of bars dedicated to forging in semi-industrial conditions and their full technical and technological assessment.

The hot forging tests carried out on a semi-industrial scale of hot extruded rods confirmed that the assumptions adopted for the hot forming process for newly developed ecological brasses allow for the development of technological assumptions for the production of water fittings elements from new alloys at each stage of the manufacturing process.

The research results obtained in this dissertation, including the description of the structure, analysis of the phase composition and tests of mechanical and functional properties, may constitute a valuable supplement to the knowledge regarding research on alloys from the group of low- and lead-free brass as well as the basis for developing full technological assumptions for the production of new alloys for water fittings elements. This will allow the launch of production in a comprehensive technological cycle based on the existing machinery, with slightly modified technological parameters adapted to the production cycle. This will significantly facilitate the implementation of new materials into production when legislative restrictions become mandatory.