

## NEW PROTECTIVE LAYER FOR CARTOGRAPHIC PRODUCTION

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**Abstract:** The process of coating moistureproof poly-para-xylylene (PPX) layers by vacuum-deposition on cartographic production manufacturing on various kinds of materials (various sorts of paper, synthetic film, materials, photopaper) is developed.

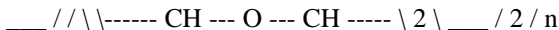
High protective properties of PPX-coatings from the influence of external factors (humidity, solutions of salts, acids, alkalis etc.) are marked.

Physico-mechanical properties of cartographic samples on the basis of paper with PPX-coating have been investigated, their improvement in comparison with unprotected samples has been established.

Investigation is carried out on the base of assortment of cartographic production of Moscow Aerogeodesic Enterprise. The conclusion is done, that the use of PPX-coating for protection of cartographic production on the basis of paper will allow to prolong essentially the time of its service both in the fields and in the room conditions and also to improve its aesthetics appearance.

In conditions of new economic relations home and foreign markets of cartographic production can be won on conditions of improvement its aesthetics appearance, operation properties and increasing the period of its exploitation. New opportunities in the decision of these tasks are opened thanks to the development the technology of deposition moistureproof poly-p-xylylene (PPX) coatings on the samples with various nature of their surface.

Poly-p-xylylene represents itself aromatic polymer which molecular unit consists from benzene ring and two methylene groups para-position :



Various derivatives of PPX with substitute groups in benzene ring as well as in methylene groups are known.

Thanks to it excellent dielectric properties, high resistance to most solvents and corrosives (oxides of nitrogen, sulphur, etc.), dimensional stability and very low

permeability PPX-coatings and its chlorine substituted derivatives find today application for protection of printed boards, integrated circuits, hybrid circuits and other devices of radio- and microelectronics.

PPX films and coatings one can receive by the process of gaseous pyrolytic polymerisation of cyclic di-p-xylylene ([2.2] - paracyclophane) which is a white, crystalline organic substance with melting point 285 - 287°C.

In Moscow Aerogeodesic Enterprise and Karpov Institute of Physical Chemistry, the investigations were done concerning the possibility of forming of PPX-coatings on the surface of cartographic production manufacturing on various sorts of paper and new properties which it received in the result of this process.

The process of forming of PPX-coatings on samples of cartographic paper of various sorts and fragments of reprints of topographic maps was carried out on automated vapour deposition equipment « Š-400 » which was worked out for protection of printed boards and other devices of radioelectronics. The largest size of plane device which one can coat on this equipment is equal to 250 x 300 mm with the total square of the surface 300 sq. dm.

The samples of cartographic paper with PPX-coating showed high protective properties during their standing in atmosphere with relative humidity 98 % for 72 hours, immersion into water for half an hour, standing in atmosphere of organic solvents (acetone, ether, hexane, etc.) for 24 hours, immersion into dilute solutions of common salt, sulphuric and hydrochloric acids, sodium hydroxide for 5 - 10 minutes.

After these tests, no swelling, no destruction or colour change of the samples were observed under visual observation.

Physico-mechanical properties of cartographic samples from paper of the grade « A » and « B » with the 100 μ thickness of each sample were investigated. The protection of these samples with the 1,0 μ PPX-coating led to strengthening and increase elasticity of the paper approximately twice in comparison with unprotected samples.

Linear deformation of various grades of cartographic paper was determined by measuring changes of the dimensions of the samples of the paper after influence on them by water and following drying in accordance with standard 6780-89 « Methods of determination of lines deformation ».

Linear deformation was determined after treatment by :

1. Water
2. Water and air at the temperature 23°C

### 3. Water and air at the temperature 60°C

Analysis of the results point to that the character of linear deformation for all grades of cartographic paper after its protection with PPX-coating remains previous : lengthening of dimensions under wetting and shrinkage - under following drying. The value of transversal linear deformation of paper with polymer coating was 2,5 - 3,5 times lower compare with unprotected paper.

After drying at the temperature 60°C, the shrinkage of the paper with PPX-coating becomes more uniform in longitudinal and transversal directions and it does not exceed 0.2 % for all grades of cartographic paper.

Investigation of the humidity of cartographic paper was done in accordance with standard 1352519-71 « Methods of determination of humidity ». The essence of this method is based on determination of the loss of the mass of the samples under drying to constant mass. The protection of cartographic paper with PPX-coating decreased its humidity on 0,5 - 0,7 %.

Investigation of whiteness of cartographic paper was done in accordance with standard 7690-76. The method is based on measuring optical density in dark blue region of the spectrum at the effective wave length 457 nm. The powder of barium sulphate as standard sample for determination of whiteness was used. Investigations showed that the value of whiteness for the samples of the paper of the grade « A » and « B » with PPX-coating does not change compare with unprotected paper and is equal to 87 %. For the paper of the grade « B » with PPX-coating the value of whiteness is equal to 85 %.

The test on sunlight stability of circulation reprints of topographic maps with PPX-coating to influence of sunlight, change of temperature and humidity was done by express-method with the help of technical means, which imitate the influence of nature factors in the conditions of map storage in room conditions beyond room window glass. For making accelerated tests the device « Xenotest-450 » of firm « Heraeus Original » (Germany) was used. With the help of this device daily changes and influence of such nature factors as light, temperature and humidity of air on paper samples were initiated in automatic regime by the help of special rule-program. As the source of light xenon-lamp of 4,5 kW power with intensity of radiation 64 W/sq. m in the region of wave length 280 - 400 nm was used.

During the tests, the next parameters were chosen : temperature of the air - 23°C, humidity - 60 % (corresponding to conditions of working apartments). Insulation of the samples on the device were carried out during 30, 80 and 185 hours, which

is corresponding to 2,5 and 12 years of influence on the samples of natural factors in the conditions of working apartments. Cartographic paints of 2 558 series, which are usually use for printing circulation reprints of topographic maps, were tested. The basic colours of paints were investigated: black (2558-01), greenish-blue (2558-38), light-brown (2558-61), orange (2558-10) and green (2558-43).

The samples of cartographic paints and fragments of circulation reprints with polymer protection and without PPX protection layer were tested.

Stability of cartographic paints was determined by their visual estimation after insulation according to eight-mark system with the usage of standards (for determination of stability of paints) of dark blue textile materials according to standards 10761-75 and 9733.0-83. Furthermore, the stability of cartographic paints was determined by measurement on densitometre behind various light-filters optical density of initial samples and the samples after insulation during 30, 80 and 185 hours. It was established that both method - visual and sensitometric - give identical results and can be use to estimation the stability of cartographic paints.

PPX-coating has high chemical stability, it does not interact with five investigated paints, it does not change their colour balance and density. After 80 hours of insulation of samples decreasing of paints density was observed and in less extent in the samples with PPX-coating protection. Process of ageing of polymer layer was observed after insulation of the samples during 31 hours.

Among the cartographic paints of 2558 series the largest stability to light have black and greenish-blue plaints ith large format files and the case is kept separately from the file. These cases are lately used for packing and storing of suitable-size maps.

The samples of cartographic production with protection from PPX-coating differ by high aesthetics properties : flat surface without folds, wrinkles, dents, mat surface without patch of light and shades, higher smoothness, etc.

So as the result of the presence of PPX-coating, the samples of cartographic production receive new properties sush as increase of strength, moistureproof. Cartographic documents of a large format such as atlases, wall and educational maps become more uniform in longitudinal and transversal directions and it does not exceed 0.2% for all grades of cartographic paper.

So the usage of PPX-coating is the way of creation of low deformed cartographic production with aesthetics appearance on the low-grade cartographic paper. In

some extent, this technology process can substitute the process of lamination of demonstrative, wall and educational maps.

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