



РОСАТОМ



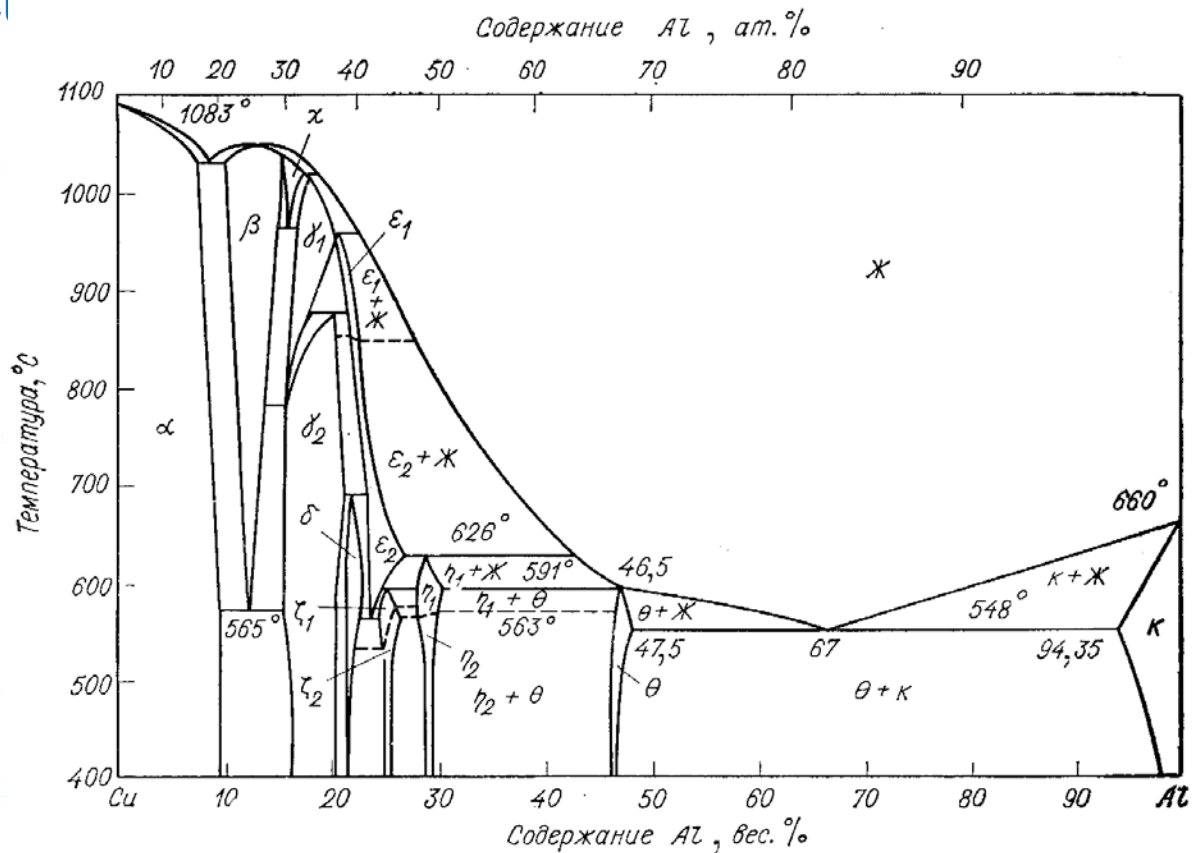
ГОСУДАРСТВЕННАЯ КОРПОРАЦИЯ ПО АТОМНОЙ ЭНЕРГИИ «РОСАТОМ»

**Technologies of getting high-durable high-modular composite material based on Al-Cu.**

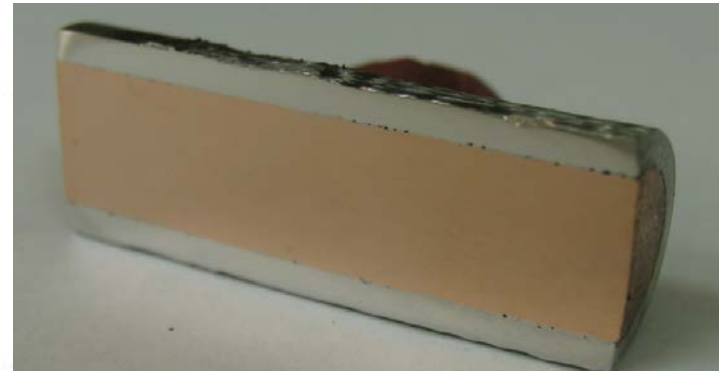
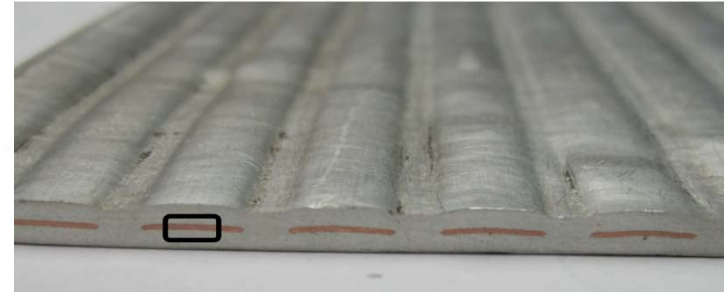
**Formation of intermetallic compounds, reinforcing the main matrix.**

**D.L. Chernyshev**

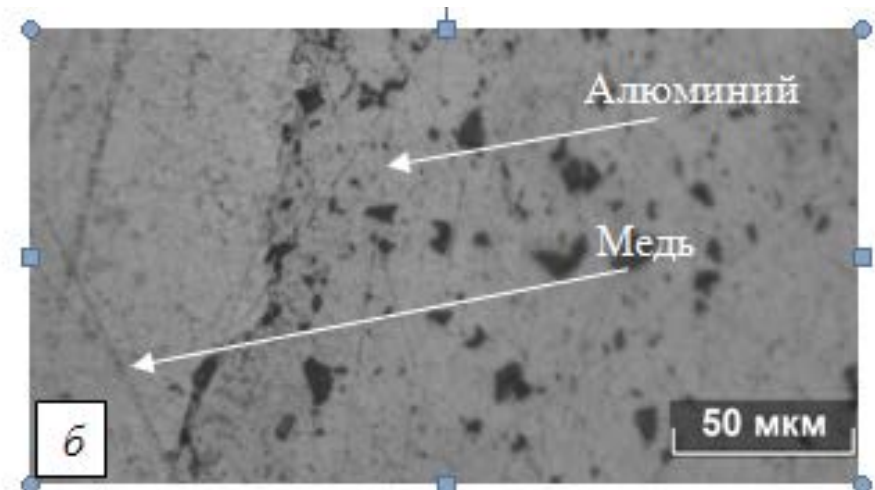
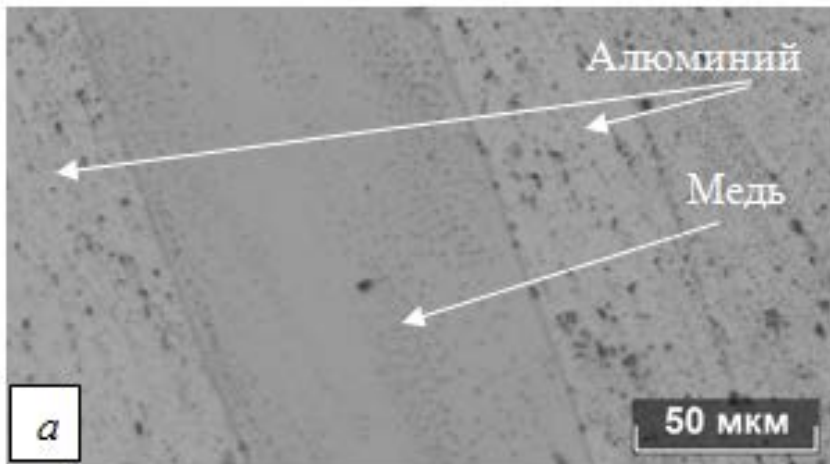
Formation of a number of intermetallic phases with the composition of  $\text{CuAl}$ ,  $\text{CuAl}_2$ ,  $\text{Cu}_3\text{Al}_2$ ,  $\text{Cu}_9\text{Al}_4$ ,  $\text{Cu}$



1. Explosion welding for getting semi-finished items (sheet, pipe, shape) with the following mechanical and heat treatment in a finished state.
2. Application of aluminium layer with a gas-dynamic spraying onto copper article which was prepared beforehand with the following heat treatment to get specified intermetallic layer.
3. Galvanic sludge of copper on aluminium article which was prepared beforehand with the following heat treatment to get specified intermetalloid layer.



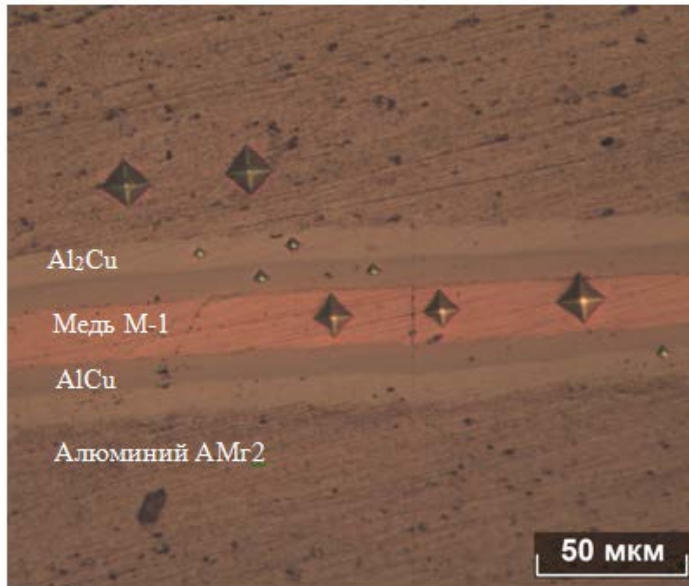
## Bimetal



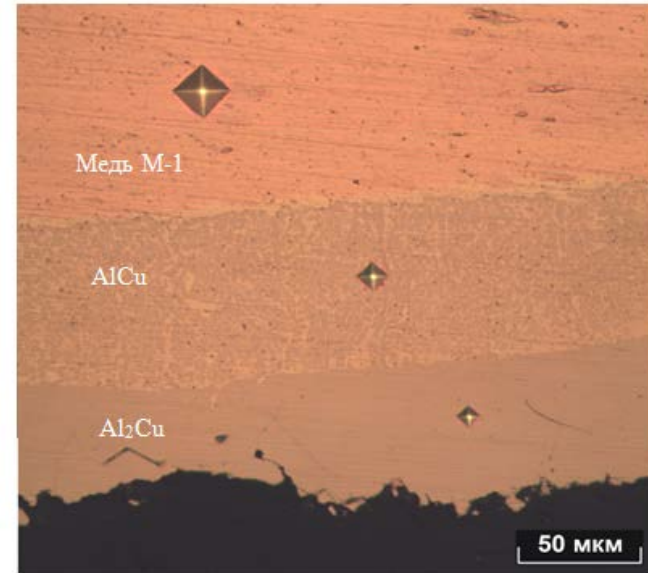
Initial state of samples derived from: a) explosion welding; б) gas-dynamic spraying (magnification  $\times 100$ )

| № sample | Method of producing                          | Hardness of a layer, HV (kgf /mm <sup>2</sup> ) | Yield point, $\sigma_{0,2}$ (kgf /mm <sup>2</sup> ) | Young's modulus, $f_{cp}$ (Hz) |
|----------|--|---|---|--------------------------------|
| 1.       | Explosion welding with the following rolling | Copper M1 - 69HV<br>Aluminium AMГ2 - 93HV       | 3,1   | 12,53                          |
| 2.       | Gas-dynamic spraying of aluminium            | CopperM1 - 54HV<br>Aluminium - 41HV             | 3,3   | 14,3                           |
| 3.       | Galvanic sludge of copper                    | Copper - 52HV<br>Aluminium AM ц - 46HV          | 2,9   | 12,45                          |

## Microstructure of composite material after heat treatment



Formation of intermetallic layer after heat treatment on the samples derived from explosion welding with the following rolling distribution of hardness on section (magnification  $\times 100$ )



Formation of intermetallic layer after heat treatment on the samples derived from gas-dynamic spraying and distribution of hardness on section (magnification  $\times 100$ )

| No sample | Method of producing                          |                     | Hardness of a layer, HV <sub>0,025</sub> (kgf /mm <sup>2</sup> )             | Yield point, σ <sub>0,2</sub> (kgf /mm <sup>2</sup> ) | Young's modulus, f <sub>cp</sub> (Hz) |
|-----------|--|---------------------|--|---|---------------------------------------|
| 1.        | Explosion welding with the following rolling | Heat in el. oven    | Al <sub>2</sub> Cu -665-752<br>AlCu -481-534<br>Aluminium-44<br>Copper-51-54 | 10,2  | 20,44                                 |
|           |  | Heat by el. current |  |   |                                       |
| 2.        | Gas-dynamic spraying of aluminium            | Heat in el. oven    | Al <sub>2</sub> Cu -665-752<br>AlCu -481-534<br>Copper-52-54                 | 10,8  | 21,61                                 |
|           |  | Heat by el. current |  |   |                                       |
| 3.        | Galvanic sludge of copper                    | Heat in el. oven    | Al <sub>2</sub> Cu -665-752<br>AlCu -481-534                                 | Fracture of the sample                                | Fracture of the sample                |
|           |  | Heat by el. current |  |   |                                       |

# Thanks for attention !

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