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MECHANISMS OF DOPING METALS FROM GAS AND LIQUID MEDIUMS BY THE ms-LONG Nd-LASER PULSES

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Ultra-high concentrations (67 atomic per cent) doping elements (carbon) have been reached in the suggested method of the laser treatment of the metals under liquid. The system iron-toluol was used in this experiment as an example. The mechanism of trasportation of doping elements into the melt zone (thickness up 100 μm) is shown to be determined both experimentally and numerically by convectional mixing of the melt metal because of the action of backing vapor forces.

The treatment of the metals (I=1+5×10^5 W/cm^2) in the gas -reagents with various chemical activity has demonstrated that the doping process has a character of thermo-chemical interaction of the melt metals with ambient gas. The following table represents some microhardnesses and nitrogen concentrations for Fe and Ti samples treated in N_2 and NH_3 gases at near 1 atm.:

<table>
<thead>
<tr>
<th></th>
<th>Fe-N_2</th>
<th>Fe-NH_3</th>
<th>Fe-VAC.</th>
<th>Ti-N_2</th>
<th>Ti-NH_3</th>
<th>Ti-VAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>H_μ max</td>
<td>550</td>
<td>650</td>
<td>350</td>
<td>2300</td>
<td>700</td>
<td>210</td>
</tr>
<tr>
<td>H_μ 100</td>
<td>425</td>
<td>525</td>
<td>350</td>
<td>1300</td>
<td>500</td>
<td>210</td>
</tr>
<tr>
<td>% at C_μ max</td>
<td>&lt;1</td>
<td>&lt;1</td>
<td>---</td>
<td>50</td>
<td>15</td>
<td>---</td>
</tr>
</tbody>
</table>

Dynamic of the laser "flash" measured by the streak camera and its temperature measured by spectral diagnostic method are discussed. Numerical modeling of heating and melting of the metals by the free-generated regime Nd-laser's pulse are discussed too.