PHYSICAL SCIENCES

INFLUENCE OF BARIUM ATOMS ON THE DISSOCIATION OF CsCl MOLECULES ON THE SURFACE OF RHENUM COATED WITH A MONOLAYER OF GRAPHITE

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Abstract

It was determined that the contact electric field of the graphite layer on the charge covered with graphite layer with Ba islands dissociates the CsCl molecule. It was established experimentally that the temperature dependence of the utilization coefficient of Ba atoms in the co-adsorption of CsCl and Ba atoms does not remain constant in the (850-950) K range.

Keywords: ionization atom and molecul, qrafit, adsorption

As a result of physicochemical processes occurring on the surface of metals in the oil industry and other technological processes, the chemical and physical activity of surfaces is disrupted, as a result of which the desired effects are weakened. For example, in the catalytic reforming process in oil refineries, the surface of the catalysts is coated with a layer of graphite as a result of the decomposition of hydrocarbons. This reduces surface activity. Various methods are used for restoring activity (oxygen release, bombardment of the surface with ions, etc.). Physical and chemical activity can be restored by creating small islands of metal on the surface of a layered metal-graphene system, but the results obtained in some cases by this method raise seriously questionable. Obtaining a monolayer of graphite - graphene - on the surface of refractory metals shows that it has unusual properties: the dissociation and ionization of molecules on the metal surface is weakened; the work of the metal surface is reduced; an intercalation zone is formed - on the surface of the metal and a layer of graphite, i.e. a kind of trap is created. Studying the influence of graphene formed on the surface of refractory metals on the dissociation of some halide salts and the joint surface ionization of atoms and molecules is of great interest for solving a number of problems in nanoelectronics and nanoparticle physics. It has been established that the mechanism of formation of graphite from carbon atoms as a result of the splitting of benzene molecules on the surface of metallic Ir differs from the mechanism of formation of graphite in metallic Re. In iridium, a monolayer of graphite is formed without diffusion into the volume, and in rhenium, the volume is first saturated to a certain concentration, and then a monolayer is formed on the surface. The monolayer of graphite reduces the dissociation and corresponding surface ionization of many alkali metal halides, the ionization coefficient being practically 10^{-5}-10^{-6}. CsCl molecules practically do not dissociate on the surface of metals with a graphite coating. We obtained the dependence of the coefficient of utilization of Ba atoms in splitting reactions on the temperature of the sample during the joint adsorption of Ba atoms and CsCl molecules on the Re-C surface in various flows (Fig. 1)

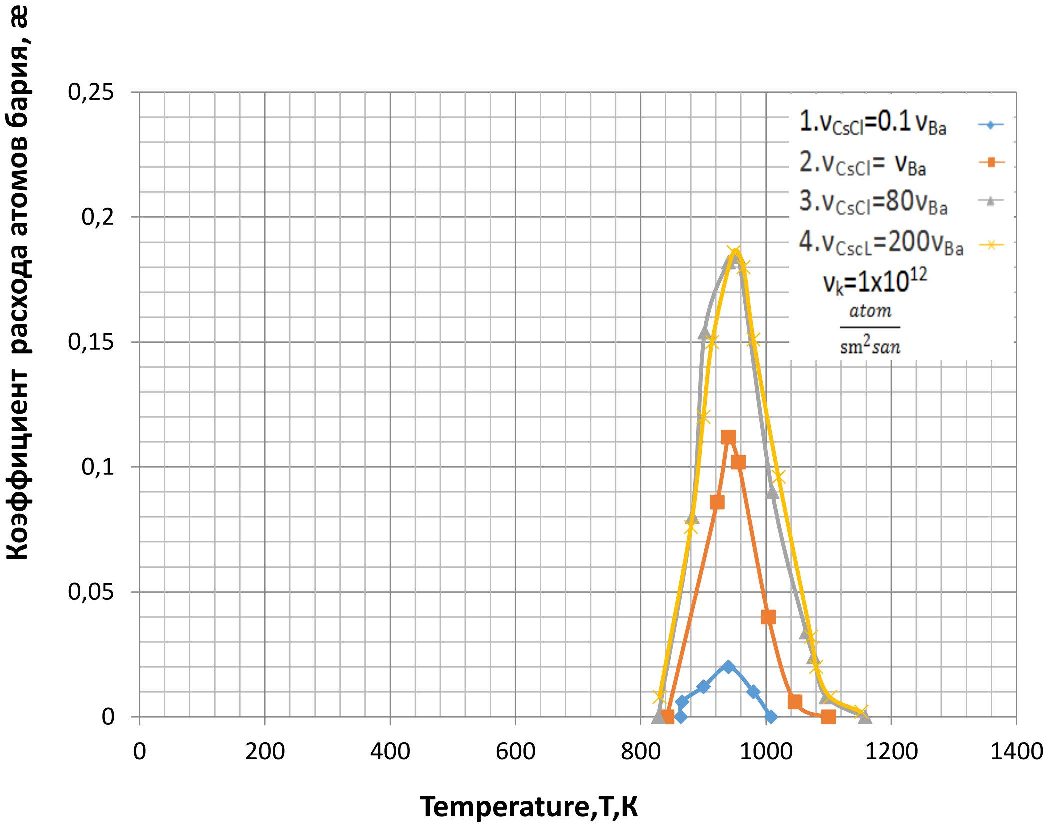

Figure1; Temperature dependence of the co-adsorption rate coefficient of CsCl molecules and Ba atoms

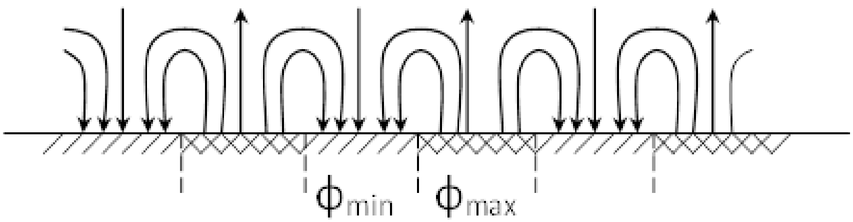

Figure 2.

These dependences differ significantly from the above works [1], since it is noted there that the utilization increases with decreasing temperature, and then the dissociation coefficient remains constant, it is also shown that this stability is the result of a chemical reaction between CsCl molecules and Ba atoms, in our opinion, this is impossible from the point of view of the degree of activity of chemical elements. In our case, with decreasing temperature, the dissociation coefficient and the coefficient of utilization of atoms monotonically increases, passes through a maximum, and with a subsequent decrease in temperature monotonically decreases to zero. This process can be explained as follows: the meeting of CsCl molecules and Ba atoms on the surface during their stay on the surface depends on their migration along the surface, is probabilistic in nature and depends on temperature. Each atom and molecule has a different energy of evaporation or desorption from the surface. As can be seen from the graph, the adsorption of these particles on the surface occurs below a temperature of 1100 K. Ba atoms on such surfaces are practically not ionized; they migrate over the surface and form various accumulations in the form of nanoparticles, an island, or a cluster. After temperature and field treatment, barium islands are formed on the Re-C surface, and the surface again becomes inhomogeneous in terms of work function. With a subsequent decrease in temperature, the number of Ba atoms on the surface increases and a layer of a certain thickness is obtained, which reduces the work function of the surface. A contact electric field arises between barium islands (φ_{min}-electron work function for barium) and the free surface of graphite) (Figure2).The strength of this contact field, depending on the size of the island, can vary from zero to approximately 10^7V/m. Molecules of cesium chlorine migrating over the surface once in this field can easily dissociate under the action of the contact field into cesium and chlorine atoms. It is known that cesium atoms formed from the dissociate of CsCl on the surface of graphite are almost 100% ionized, and chlorine atoms forming Cl_2 are pumped out. The decrease in the consumption coefficient of the Ba atom below the temperature of 950K, corresponding to the maximum dissociation coefficient, is an associated with a decrease in the work function. When the surface is completely covered with barium atoms, the work function of the surface is the same as for pure barium ~2eV, the contact field practically decreases to zero and if the condition $e(\varphi-V) \gg kT$ is met, ionization of atoms does not occur (In the case of difficult ionization). The same experiment was carried out with KI molecules and Ba, Na, Cs atoms and in all cases the above dependences obtained were similar. This further confirms that the left side cannot constant depending on temperature.

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