radiation. The registration of the radiation output from the photodetector (PD) was possible in the flow mode and in the photon-counting mode. When using a lamp with a hollow cathode of silver as a source of input radiation, only two lines of silver were observed in the radiation output of the RM - 328.1 and 338.3 nm. The line at 328.1 nm was at an intensity of 63% of the entire level of light received (in an RM with a hollow cathode, this line took up about ~20% of the entire radiated light field). The resolving ability of the RM was ~2×10⁻⁴ nm. Such an RM can be useful for AA and AF analyses of isotopes.

LITERATURE CITED


RELATIVE EXCITATION PROBABILITIES OF ROTATIONAL LEVELS OF THE
STATE $H_2(G_8^1P)$ BY ELECTRON IMPACT IN A GAS DISCHARGE

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One of the main excitation channels of the spectra of atoms and molecules in plasma is electron impact. It is therefore important to establish the laws of variation of the vibrational and rotational quantum states and also of translational motion of molecules in the excitation of the electron shell by electrons.

The features of the excitation of electron-vibrational states by electrons were studied in particular in [1-3]. The features of the transformation of translational motion of particles on excitation by electron impact were described in [4]. The question of the change in rotational quantum numbers on excitation of the electron shells of molecules by direct electron impact was discussed earlier mainly in the context of using a spectroscopic method of determining the temperature of neutral gas of low-density plasma [5, 6]; however, it is of general physical interest. The initial prerequisite of the method of relative intensities in the rotational structure of molecular spectra is the assumption duplicating properties of direct electron impact, i.e., of retention of the rotational moment of the molecule on excitation [5, 7]. This traditional assumption was not justified until recently, however.

Attempts at the quantitative study of this question were recently made independently in [6, 8-11]. In particular, confirmation was found for the conclusion, first reached in [6], that considerable change in angular momentum of the molecules may occur in the excitation...
Fig. 1. Temperature dependences of $a_{k'k''}$ determined experimentally in accordance with Eq. (2) for the lines R2 (1), R4 (2), and R6 (3) and the 0-0 band of the electron transition of ortho hydrogen $H_2 (g_1 \Sigma_g^+ \rightarrow B_1 \Sigma_g^+)$. The value of $a_{k'k''}$ for the R0 line is taken as unity.

Fig. 2. Dependence of the relative excitation probabilities of rotational levels of the electron-excited states $\alpha_{1+k}$ on $\Delta k$. All the curves are normalized to unity at the maximum. Transitions $H_2 (X^1 \Sigma_g^+ \rightarrow d \Pi_u)$ [6] (1); $H_2 (X^1 \Sigma_g^+ \rightarrow F \Pi_g)$ [8] (2); $N_2 (X^1 \Sigma_g^+ \rightarrow N_2^+ (B^1 \Sigma_g^+)) [11]$ (3); $H_2 (X^1 \Sigma_g^+ \rightarrow G \Pi_g)$ of the present work (4); $H_2 (X^1 \Sigma_g^+ \rightarrow d \Pi_u)$ [9] (5) and $N_2 (X^1 \Sigma_g^+ \rightarrow N_2^+ (B^1 \Sigma_g^+)) [10]$ (6).

TABLE 1. Experimental Values of $\tau_{k'k''}$, the Relative Intensity of the Rotational Lines $I_{k'k''}$, and the Relative Probability of Excitation $a_{k'k''}$

<table>
<thead>
<tr>
<th>Line</th>
<th>$k'$</th>
<th>$\tau_{k'k''}$, rel. units</th>
<th>$I_{k'k''}$</th>
<th>$a_{k'k''}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>R0</td>
<td>1</td>
<td>1</td>
<td>41±4</td>
<td>1</td>
</tr>
<tr>
<td>R2</td>
<td>3</td>
<td>10±2</td>
<td>100</td>
<td>0.923±0.08</td>
</tr>
<tr>
<td>R4</td>
<td>5</td>
<td>50±10</td>
<td>33±2</td>
<td>0.077±0.03</td>
</tr>
<tr>
<td>R6</td>
<td>7</td>
<td></td>
<td>7±1</td>
<td>0.003±0.0012</td>
</tr>
</tbody>
</table>

of the electron states. Quantitative data on the rotational-transition probability were obtained for the excitation of the electron states $H_2 (d^3 \Pi_u)$, $H_2 (F^1 \Pi_g)$, and $N_2^+ (B^1 \Sigma_g^+)$. In the present work, the relative excitation probabilities of rotational levels of the state $H_2 (G^1 \Sigma_g^+)$ of hydrogen molecules by direct electron impact from the ground state are determined, in conditions of nonequilibrium plasma of a reduced-pressure glow discharge.

The method proposed in [6] is used. Its basis is that, at low gas temperatures in a glow-discharge plasma (with cooling of the discharge-tube walls by liquid nitrogen), it is possible to realize a situation in which practically only one rotational level $k^o = 1$ is populated in the ortho modification of hydrogen in the electron ground state $H_2 (X^1 \Sigma_g^+)$. Then the relative excitation rates $d_{1k'}$ from the level $k^o = 1$ to the rotational level $k'$ of the upper state excited by direct electron impact are found (under the assumption of radiative decay of the upper state) simply from measurements of the relative radiation-line intensities $I_{k'k''}$:

$$a_{1k'} = \text{const} \frac{I_{k'k''}}{\tau_{k'k''} \cdot A_{k'k''} \cdot \nu_{k'k''}} \quad (1)$$

Here $k'$ and $k''$ are the rotational quantum numbers of the upper and lower states of the radiative transition; $\tau_{k'}$ is the radiative lifetime of level $k'$; $A_{k'k''}$ and $\nu_{k'k''}$ are the radiative-transition probability (Einstein coefficient) and frequency of the transition $k' \rightarrow k''$, respectively.