INTRODUCTION

Raman spectra of $\text{Cd}($NH$_3$)$_4$ (ReO$_4$)$_2$ and with 15N isotopic substitution were previously reported$^6$. To date, the isotopic shifts in 110Cd/116Cd and H/D for the tetrammine-cadmium (II) perenate complex were not informed. The Raman spectrum of $\text{Zn}($NH$_3$)$_4$Cl$_2$, with 15N/15N$_2$, 64Zn/64Zn$_2$ and H/D isotopic substitutions has been published in$^3$. In the Raman spectrum of $\text{Cd}($NH$_3$)$_4$ (ReO$_4$)$_2$ only one band pertaining to the cation complex was observed$^9$. In the present work the ir. and Raman skeletal frequencies and isotopic shifts for the tetrammine-cadmium (II) perenate complex are reported.

EXPERIMENTAL

The method followed for the preparation of the cadmium tetrammine complexes correspond roughly to that one reported in the literature$^{1,8}$. This method leads to a high yield of metal perhenates but is suited only for large quantities. To work with small quantities of the substances, the following procedures were adopted. Solutions of CdCl$_2$ were treated with stoichiometric quantities of solid AgReO$_4$ in suspension and gaseous ammonia was passed through the filtered solution of the above reaction products. The derived complexes were dried over KOH.

110CdCl$_2$ and 116CdCl$_2$ were obtained reacting 110Cd and 116Cd with HCl. In the synthesis of the labeled complexes, in each case 100ng of solid AgReO$_4$ and corresponding stoichiometric quantities of CdCl$_2$ were allowed to react in minimum possible volume of the solutions.

RESULTS AND DISCUSSION

The normal modes for the [MX$_2$]$_2^+$ framework (X=NH$_3$), in a Td symmetry can be represented by:

\[ \gamma (T_d) = \sigma_v (R) + \sigma_g (R) + 2 \beta (1R,1R) \]

In the Raman spectra, in the 450 - 100 cm$^{-1}$ region, in addition to the anion band, two bands were observed (see Table I) which can be assigned to \( \nu_2 (\text{CdN}) \) (a$_2$) and \( \delta_2 (\text{NCdN}) \) (c), respectively.

Theoreticaly, the H/D skeletal isotopic shifts are expected to be observed for all the three symmetry species. In the (a$_2$) and (c) species, the analy-
tional expressions for the $\alpha$ matrix do not include the metal's ratio for the metal labeled complexes is equal to unity. The uncertainty in the determina-

d Table I: FRAMEWORK FREQUENCIES AND ISOTOPIC SHIFTS (cm$^{-1}$) FOR [Cd(NH$_3$)$_4$]$^{2+}$

<table>
<thead>
<tr>
<th>Species</th>
<th>$\nu_1$ (s)</th>
<th>$\nu_2$ (s)</th>
<th>$\delta_3$ (NCdN)</th>
<th>$\nu_3$ (s)</th>
<th>$\delta_4$ (NCdN)</th>
<th>$\nu_4$ (s)</th>
<th>$\delta_5$ (NCdN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Cd(NH$_3$)$_4$]$^{2+}$</td>
<td>387.0</td>
<td>162.5</td>
<td>0.5</td>
<td>372.0</td>
<td>0.5</td>
<td>167.5</td>
<td>0.5</td>
</tr>
<tr>
<td>[110Cd(NH$_3$)$_4$]$^{2+}$</td>
<td>387.0</td>
<td>162.5</td>
<td>0.5</td>
<td>372.0</td>
<td>0.5</td>
<td>167.5</td>
<td>0.5</td>
</tr>
<tr>
<td>[111Cd(NH$_3$)$_4$]$^{2+}$</td>
<td>360.0</td>
<td>146.0</td>
<td>0.5</td>
<td>348.0</td>
<td>0.5</td>
<td>155.0</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Isotopic shifts

<table>
<thead>
<tr>
<th>$\Delta \nu_1$</th>
<th>$\Delta \nu_2$</th>
<th>$\Delta \nu_3$</th>
<th>$\Delta \nu_4$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 (R)</td>
<td>0.0 (R)</td>
<td>0.0 (R)</td>
<td>0.0 (R)</td>
</tr>
<tr>
<td>27.0 (R)</td>
<td>2.0 (R)</td>
<td>16.5 (R)</td>
<td>23.0 (R)</td>
</tr>
</tbody>
</table>

H/D 27.0 2.0 (R) 16.5 2.0 (R) 12.5 2.3 (R)

RESUMO


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REFERENCES


