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Leonid Khriachtchev

Department of Chemistry, University of Helsinki, P.O. Box 55, Helsinki FI-00014, Finland

E-mail: leonid.khriachtchev@helsinki.fi

**Matrix-isolation studies of non-covalent interactions:
more sophisticated approaches**

Matrix isolation is a powerful method to study non-covalent interactions, including hydrogen bonded species. The complexation effect is commonly analyzed by comparing vibrational spectra of the complex and the monomers. Most traditionally, molecular complexes in matrices are prepared by adding two species to the matrix gas and depositing the matrix at somewhat elevated temperatures and/or annealing the matrix after deposition. However, this general strategy is less suitable for the species that are difficult or impossible to prepare in the gas phase, for example, for highly reactive and unstable species. In addition, this method leads to relatively small amounts of the 1:1 complexes with an interference of monomers and larger clusters.

Key words: matrix isolation, hydrogen bond, Cryocrystals hydrates.

Л. Хриachtчев

**Исследование нековалентных взаимодействий методом
матричной изоляции: более сложные подходы**

Матричная изоляция является мощным методом изучения нековалентных взаимодействий, включая виды водородных связей. В настоящей работе мы описываем сложные подходы, позволяющие изучать комплексы, являющиеся проблематичными для исследования традиционными методами. Взаимодействие гидратов инертных газов с другими веществами может быть изучено в твердой матрице. Конформеры с более высокой энергией могут быть стабилизированы в комплексах с сильной водородной связью. Мы также обсуждаем особые случаи, при которых спектральные сдвиги небольшие, и прямое спектроскопическое доказательство образования комплексов не доступно.

Ключевые слова: матричная изоляция, водородная связь, криокристаллы, гидраты.

Л. Хриachtчев

**Ковалентті емес өзара әрекеттесулерді матрицалық
изоляция әдісімен зерттеу: айтарлықтай күрделі тәсілдер**

Матрицалық изоляция сутекті байланыстың түрлерін қосқанда, ковалентті емес өзара әрекеттесулерді зерттеудің қуатты әдісі болып табылады. Бұл жұмыста біз дәстүрлі әдіспен зерттеуде мәселе тудыратын кешендерді зерттеуге мүмкіндік беретін күрделі тәсілдерді сипаттаймыз. Инертті газдардың гидраттарының басқа заттармен өзара әрекеттесуі қатты матрицада зерттелуі мүмкін. энергиялары жоғарырақ конформерлер күшті сутекті байланысты кешендерде тұрақтандырылуы мүмкін. Сонымен қатар біз спектрлік ауытқулар үлкен емес және кешендердің түзілуінің тікелей спектроскопиялық дәлелденуі қолжетімсіз болатын ерекше жағдайларды талқылаймыз.

Түйін сөздер: матрицалық изоляция, сутекті байланыс, криокристалдар, гидраттар.

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prepared by adding two species to the matrix gas and depositing the matrix at somewhat elevated temperatures and/or annealing the matrix after deposition. However, this general strategy is less suitable for the species that are difficult or impossible to prepare in the gas phase, for example,

for highly reactive and unstable species. In addition, this method leads to relatively small amounts of the 1:1 complexes with an interference of monomers and larger clusters.

We describe sophisticated approaches allowing studies of complexes that are problematic for the traditional method. For example, photolysis of a suitable precursor can lead to a large concentration of 1:1 complexes, which are otherwise very difficult to prepare (e.g., $\text{H}_2\text{O}\cdots\text{O}$) [1].

Photolysis of two species combined with annealing can produce complexes of radicals via reactions of primary complexes with mobile atoms (e.g., $\text{H}_2\text{O}\cdots\text{HCO}$) [2]. Interaction of

noble-gas hydrides HNgY with other species can be studied in solid matrices (e.g., $\text{N}_2\cdots\text{HArF}$), and the blue shift of the H–Ng stretching mode is a normal effect in this case [3]. Many complexes and dimers have been prepared for the higher-energy conformer of formic acid cis-FA [4], even the cis-FA solid [5], by using selective vibrational excitation of the lower-energy (trans) form. The higher-energy conformer can be efficiently stabilized in complexes with strong hydrogen bonding. We also discuss specific cases when spectral shifts are very small (e.g., $\text{phenol}\cdots\text{Xe}$) [6], and the direct spectroscopic evidence of the complex formation is not available.

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