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Simulating interstellar temperatures in the laboratory to study the gas-phase OH+NH2CHO reaction

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The kinetic study of neutral-neutral reactions in the gas phase at ultralow temperatures is undergoing a huge advancement over the last decades [1]. Such studies have exponentially increased due to the increasing number of new molecules detected in the interstellar medium (ISM), specially in the coldest regions (10-100 K). To model the chemistry occurring in these extreme environments, the formation and destruction routes for IS molecules have to be characterized by means of the rate coefficient, *k(T)*, a crucial parameter to be included in astrochemical networks. For most neutral-neutral reactions, *k(T)* is usually extrapolated down to 10 K from kinetic data reported at high temperatures (>200-300 K). However, this procedure usually fails and *k*(10 K) is underestimated by several orders of magnitude, which obviously comes up with dramatic consequences in IS chemical modelling. For that reason, mimicking interstellar conditions in the laboratory and measuring accurate *k(T)* are essential. First, a suitable technique, such as the so-called CRESU (French acronym for Reaction Kinetics in a Uniform Supersonic Flow) is used to achieve the very low temperatures of the ISM to determine *k(T)* as a function of T [2]. In this work, a pulsed CRESU system has been employed to study the temperature dependence of *k(T)* between 11.7 and 177.5 K for the reaction of formamide (NH_2CHO) with hydroxyl (OH) radicals, key intermediates in IS chemical processes. It is thought that NH_2CHO, which was first detected towards Sagittarius B molecular cloud [3], can play a crucial role in the formation of prebiotic molecules in space. The available experimental *k(T)* for the titled reaction is scarce and only reported around 300 K [4,5]. However, theorical calculations predict an increase of *k(T)* when temperature decreases in the 200-350 K range [5]. Our kinetic study in the low-temperature range confirms that below 200 K, *k(T)* increases when temperature is lower, with an increase of *k(T)* in the whole temperature range with respect to k(300 K). The observed T-dependence of *k(T)* will be discussed and an expression for its use in pure- and gas-grain astrochemical models will be provided.

References

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Authors: GONZÁLEZ PÉREZ DE MADRID, Daniel (UNIVERSIDAD DE CASTILLA-LA MANCHA); ESPINOSA GÓMEZ, Sara (UNIVERSIDAD DE CASTILLA-LA MANCHA); BALLESTEROS RUIZ, Bernabé (UNIVERSIDAD DE CASTILLA-LA MANCHA); ALBALADEJO PÉREZ, José (UNIVERSIDAD DE CASTILLA-LA MANCHA); JIMÉNEZ MARTÍNEZ, Elena (UNIVERSIDAD DE CASTILLA-LA MANCHA)

Presenter: ESPINOSA GÓMEZ, Sara (UNIVERSIDAD DE CASTILLA-LA MANCHA)

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