Three players in the interstellar clouds: dust grains, known free radicals and diffuse band carriers

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Translucent interstellar clouds produce typically three kinds of absorptions: continuous extinction, identified bands of simple radicals (OH, OH^+, CH, CH^+, NH, CN, C_2 and C_3) and more than 400 unidentified diffuse interstellar bands. The latter are commonly believed to be carried by some complex molecular species but none of them was until now identified beyond a doubt.

Extinction is believed to be caused by interstellar dust particles of various sizes and shapes. The recent surveys of the extinction curves (extinction law) demonstrate a great variety of the observed curves which proves that grains are different if observed in different clouds. The applicability to a majority of object the average extinction curve follows the fact that a majority of distant OB stars is observed through several clouds and thus we observe usually an ill-defined average which does not differ substantially from one distant object to another.

The most popularly observed CH molecule does correlate with the colour excess (caused by grains) but it is a rather poor correlation. It is also interesting that CH and CH^+ may occupy completely different environments (of different radial velocities) and are thus likely being formed in different reactions, i.e. CH^+ is not a result of CH ionization. The abundance of CN molecule is completely uncorrelated with the colour excess. It is a very specific molecule: the strength ratios of the first observed CN band lines gave the first suggestion that the molecule is rotationally excited. Some 25 years later the source of excitation was indicated as cosmic background radiation.

It seems important that an exceptionally high abundance of CN is observed together with high far-UV extinction and very low intensity of diffuse interstellar bands. In fact interstellar molecules can be formed either in the gas phase or on grain surfaces. Small grains, responsible for the far-UV extinction, can efficietly catalyse molecule formation reaction – perhaps that of CN. However, the simple species, such as CN, can also be formed as a result of disruption of larger species, such as diffuse band carriers. It is difficult to guess which of these processes takes place in at least some of translucent interstellar clouds.

The shortest carbon chain molecules (centrosymmetric ones) are seemingly abundant in the same clouds in which CN is abundant. However, the observations of such species are scarce because their spectral bands contain many weak features and thus are not observed in many objects.