

Airbags will become more secure

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"Despite the fact that motorcars of established companies have long ago been equipped with airbags, gas generating compositions in them are still far from perfect, says David Lempert, Ph.D. (Chemistry), one of the development authors. The problem is that the requirements to these compositions are rather firm, multiple and sometimes difficult to combine.

Evidently, the airbag powder should burn down instantly, i.e. within 50-60 milliseconds. Along with that, sufficient volume of gases should be formed to fill in the airbag and to protect a person from a blow. At the point of accident, the powder should instantly ignite and burn down at the predetermined combustion rate, i.e. this should be absolutely safe for the car and the passengers, and during all the rest of the time it should preserve exceptional stability - during the 10 to 15-year shelf life, in rainy, frosty and hot weather at the temperature of up to + 110 degrees C it should remain invariably ready, but be insensitive to shaking, friction and blows. Besides, it is necessary that the compositions burned down producing no smoke and detrimental products, such as nitric oxide and carbon monoxide, and making minimal amount of steam."

Multiple requirements did not discourage the researchers. It is no wonder, as the specialists of the Institute of Problems of Chemical Physics, Russian Academy of Sciences, possess unique experience in creating common powders and solid propellants. It is clear that the powder for motorcars should be based on atoms of only four elements - carbon, hydrogen, nitrogen and oxygen. The software developed by the

authors for mathematical modelling of the powder composition provided several potentially suitable structures. Some of them have already been synthesized and approbated, the synthesis and testing of others is still forthcoming.

It has turned out that there is no better foundation than ammonium nitrate (sold in any fertilizer shop) for such powder yet. This is unsurpassed oxidant for self-burning smokeless compositions, although it has some drawbacks. However, the difficulty is that this compound absorbs moisture during its shelf life, so it may cake or petrify. The problem has been a concern of all ammonium nitrate storehouses for a long time. This is in general the trouble with ammonium nitrate - i.e., it can exist in various phase states, characteristics of which, and most importantly density, vary significantly.

"We tried to overcome such instability by creating the so-called cocrystallizer of ammonium nitrate with its other compound - ammonium formate, explained David Lempert. In essence, this is a new substance, its characteristics being different from those of base salts. Detailed investigations showed that it performs oxidant functions no worse than the base ammonium nitrate does, but it does not cause the "phase state" difficulties. Crystals of the new compound have no phase transformations in the range of -50 through +80 degrees C, and it makes ammonium formate a very good candidate for gas generating composition, its storage temperature condition being up to 80 degrees C."

However, the researchers did not limit their effort to the development of chemical composition of smokeless and nontoxic powder for motorcar airbags. They also invented the way to form the charge so that that it could burn down in fractions of a second. Nevertheless, the fuel charge structure suggested by the authors is a secret they do not disclose. The conducted experiments prove - they have managed to increase

combustion rate by several times. So the "inflatable defence" developed in a new way by Russian researchers will work quicker and more reliably than the traditional one. Although in case of an accident the passenger or the driver will have to spend a short period of time inside the car, there will be neither smoke nor toxic gases from the airbag, so they would not do any harm.

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