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## Development of the hollow detonative chamber for the RDE applications

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### Abstract

Recently intensive research on applications of the continuously rotating detonation (CRD) to the propulsion systems are carried out at the many laboratories [1-5]. Also at the Łukasiewicz – Institute of Aviation extensive research on this subject are carried out for more the twelve years. The gas turbine with detonative combustion chamber was tested and the first world's experimental rocket powered by detonative engine was successfully launched [4-5]. During last few years intensive research on development of CRD chamber fed with liquid fuels were carried out. Development of such chamber is essential for the introduction of detonative propulsion to the aeronautical engines. Most important in those research are development of detonation chamber which will support stable detonation for jet fuel air mixtures. Additionally it is very important to minimize pressure losses during mixture formation and simultaneously prevent a flash-back of flame to the mixture zone. A few different systems of mixture formation were already tested and some of those systems were also patented [6]. One of the open questions in this research is the problem of so called "pressure gain" of the system. Theoretically, rotating detonation engines (RDE) is the system which offers significant pressure gain as well as significant improvement of efficiency over classical combustion chambers used in recent propulsion systems. Up to now experimentally tested detonation chambers did not result in theoretically promised pressure gain, but most often demonstrated the pressure losses. Most advanced systems show only minimum pressure losses and total "pressure gain" close to zero. But to obtain a real advantage of the CRD the developed chambers have to demonstrate positive pressure gain of the system. Only that will allow for practical introduction of the CRD to propulsion system. A few different systems of the CRD chamber supplied by jet fuel-air mixtures are recently tested at the Institute. One of the very promising system is the hollow detonative combustion chamber. Different geometry of the fuel supply and different geometry of the hollow chamber are recently tested. All subsystems are subject of optimizations, especially mixture formation, since most pressure losses are connected to this subsystem. Selection of the hollow detonation chamber allow lower heat and pressure losses in comparison to the annular chambers which are most often used in tested RDE. Very important is also selection of the ignition system, since such system should guarantee not only generation of the CRD but also smooth initiation of chamber/engine operation. So in this paper all aspects of the development of hollow detonation chamber which should demonstrate the positive pressure gain and might be applied in future aeronautical propulsion system will be discussed. Also possible research of the further improvement of such system will be presented.

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