Name of the organization
Karlsruher Institut für Technologie (KIT)

Name of the infrastructure / laboratory
HYKA-A1 Facility (a Large Scale Safety Vessel)

Address and country of the infrastructure / laboratory
Karlsruher Institut für Technologie (KIT)
Campus Nord, Hermann-von-Helmholtz-Platz 1 - 76344 Eggenstein-Leopoldshafen, Germany

Person responsible of the access / Contact person
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Main field of activity of the infrastructure / laboratory
- *Hydrogen safety, refueling, hydrogen storages*

Short description of the infrastructure / laboratory
The safety vessel A1 has main dimensions of 3.5 m id and 12 m length with a volume of 100 m3. It was certified at maximum static pressure of 100 bar. The vessel may be used as a safety vessel or filled itself with a hydrogen-air mixture at ambient conditions. A rectangular sub-compartment of 9 x 3 x 0.6 m3 may be used to study a combustion and detonation in a horizontal semi-confined layer of hydrogen air mixture. The vessel is equipped with measuring ports and windows for visual observations. The existing gas-filling system allows creating a layer of hydrogen-air mixtures with a linear vertical concentration gradient from 0.1 to 1.1 %H2/cm. It has a semi-spherical cover to open/close whole cross-section of the vessel. Combined with vessel A3, it can be used for combustion propagation tests in a multi-compartment geometry. The measuring system consists of thermocouples array (gas temperature, flame arrival time); piezoelectric and piezoresistive gauges (initial pressure, explosion pressure); gas analyzer and mass spectrometer (to control mixture composition); sonic hydrogen sensors, photodiodes and ion probes (flame arrival time, flame speed), strain gauges (deformations). The data acquisition system is based on multi-channel (64) ADC with a sampling rate of 1 MHz. The vessel was successfully tested for detonation of 16 m3 of stoichiometric hydrogen-air mixture at ambient pressure and temperature.

Main research area(s) of the infrastructure / laboratory
Turbulent hydrogen combustion in uniform and nonuniform gas mixtures at ambient conditions; flame acceleration and detonation experiments in confined and semi-confined geometries, effect of venting on flame propagation regimes; high pressure hydrogen releases, experiments on hydrogen distribution, structural response of piping structures to internal pressure loads, integrity of high pressure tanks under external and internal pressure loads, to use as a safety vessel for small hydrogen inventory facilities (as explosion tubes and chambers, hydrogen fuel cells and forklifts).

Instruments and tools available for the above mentioned research
Hydrogen injection system, rectangular sub-compartment of 9 x 3 x 0.6 m3 with of without obstruction grid, high speed imaging system combined with BOS technique.