Chemical Aspects of Hydrogen Technology

Professor Neil R. Champness

School of Chemistry

Nottingham Nanoscience and Nanotechnology Centre

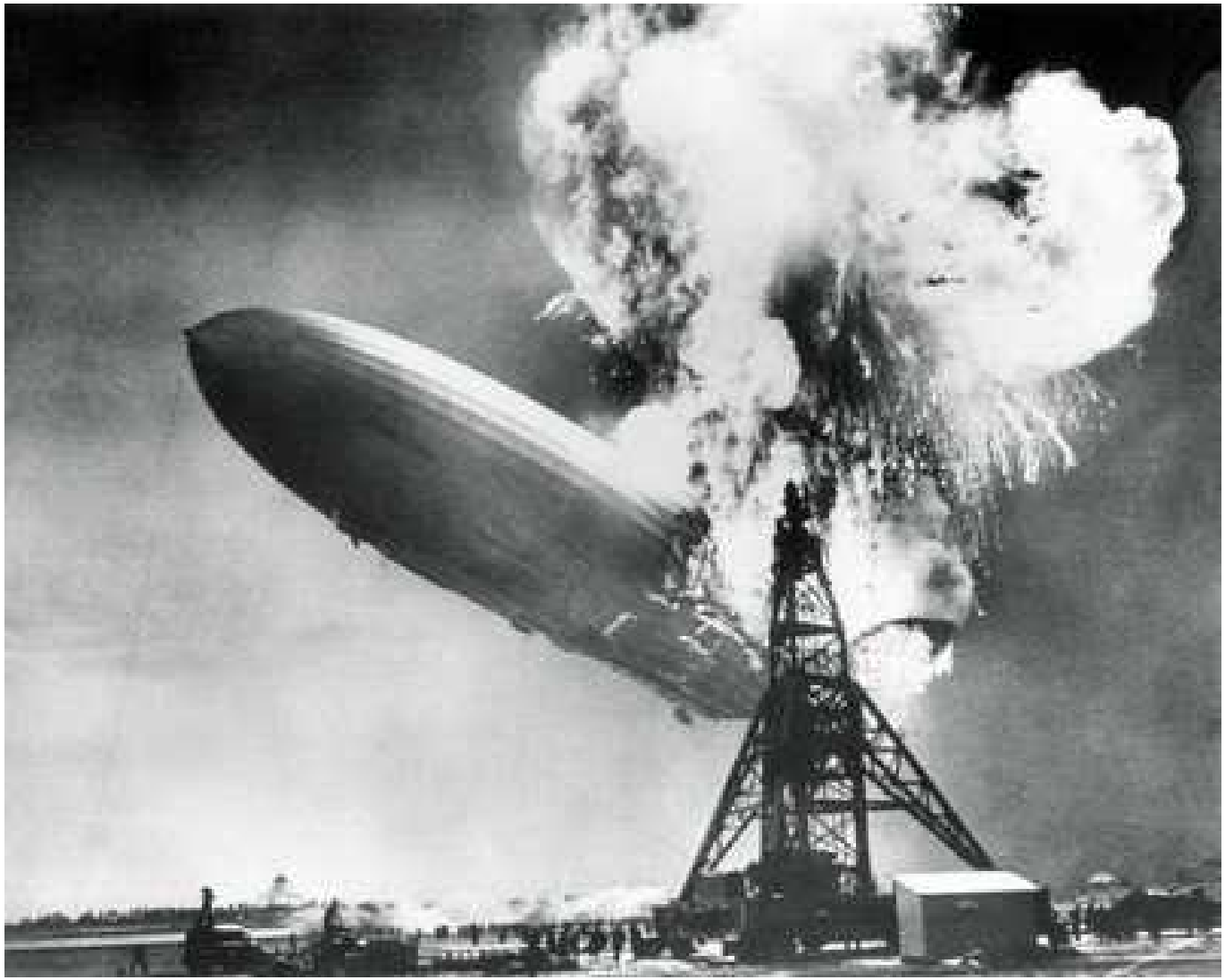
University of Nottingham

Neil.Champness@nottingham.ac.uk

Hydrogen Fuels

Hydrogen Fuels

Hydrogen-fuelled buses already run in Berlin.



Hydrogen Fuels

Hydrogen Fuels

US Department of Energy 2010 targets
6.5 wt% H_2 gravimetric
45 g/L volumetric capacity

2015 targets
9.0 wt% H_2 gravimetric
81 g/L volumetric capacity

Hydrogen Storage Technologies

The University of Nottingham

Liquid hydrogen	Cryo-adsorption	Interstitial metal hydride	Compressed hydrogen	Alanate	Salt-like metal hydride	Water
LH_2	Activated carbon	Laves Phase Comp. / $FeTiH_x$ / $LaNi_5H_x$	CGH_2	$NaAlH_4$	MgH_2	H_2O
100 mat.wt.%	6.5 mat.wt.%	2 mat.wt.%	100 mat.wt.%	5.5 mat.wt.%	7.5 mat.wt.%	11 mat.wt.%

Operating temperature

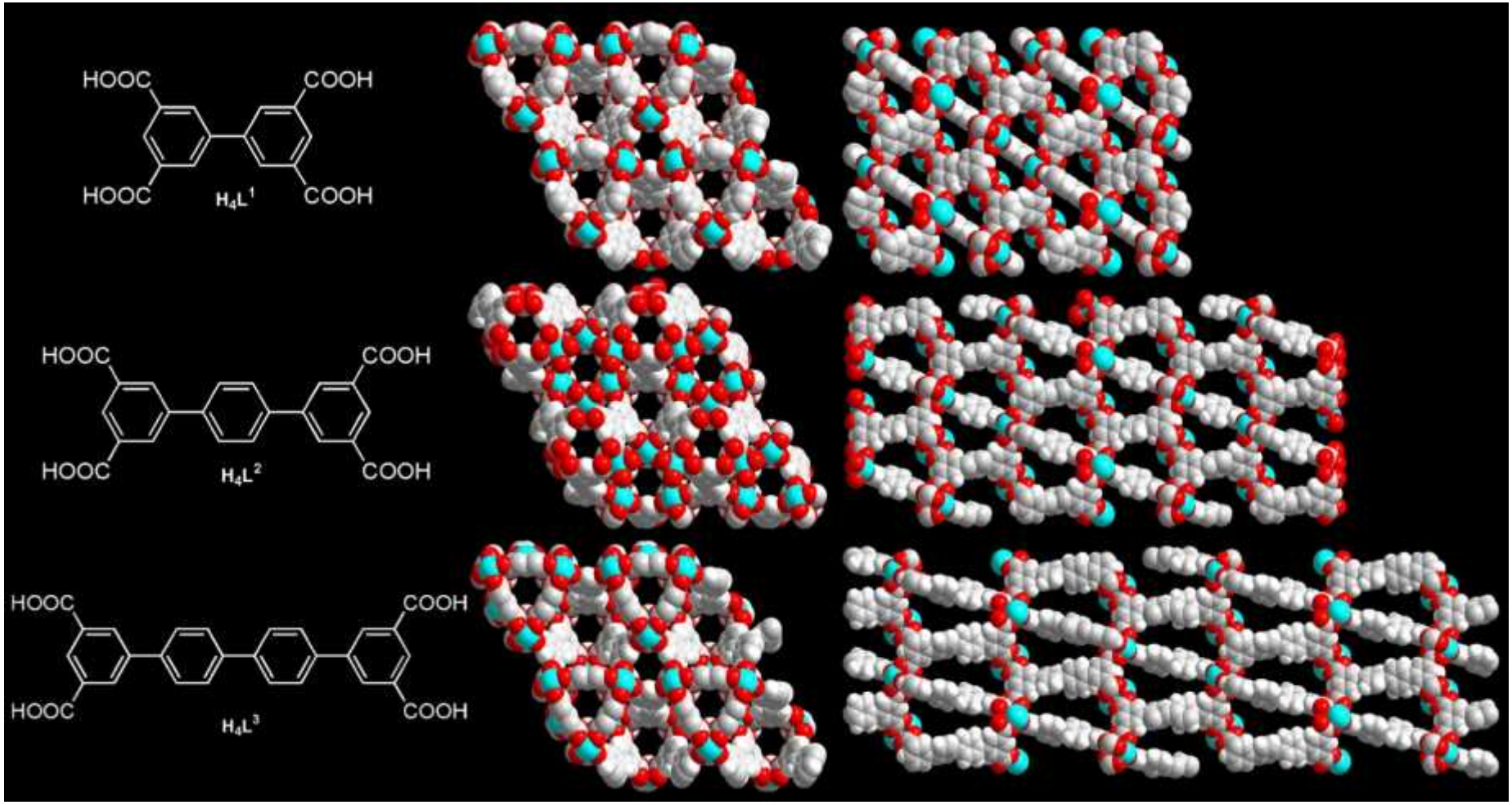
-253°C	> -200°C	0 - 30°C	25°C	70 - 170°C	330°C	>> 1000°C

Corresponding energy to release hydrogen in MJ per kg H_2

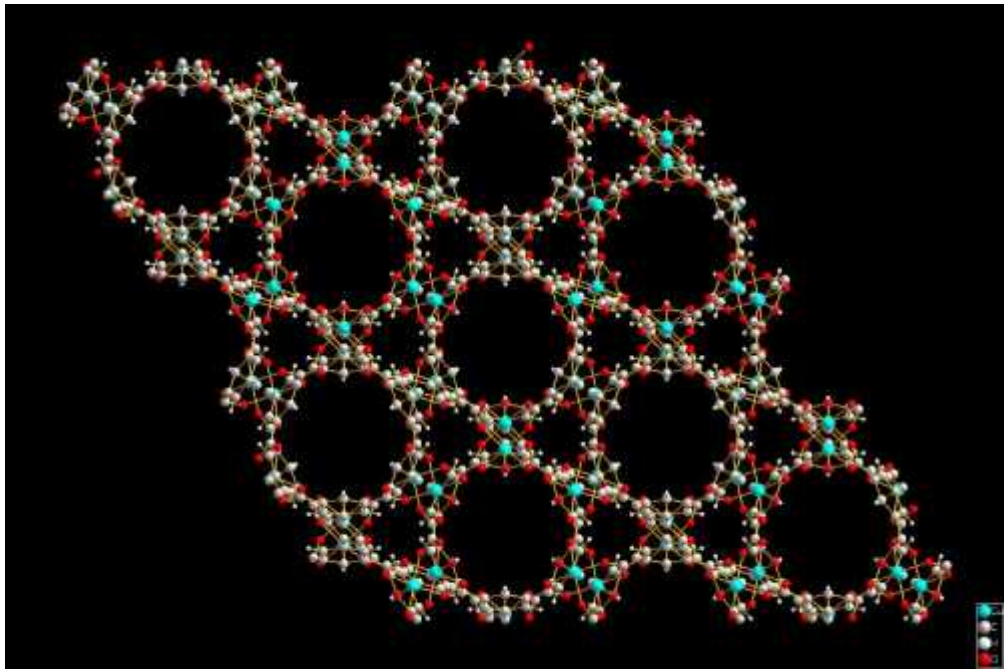
0.45	3.5	15	n/a	23	37	142

The University of Nottingham

Metal-Organic Frameworks (MOFs) H_2 storage



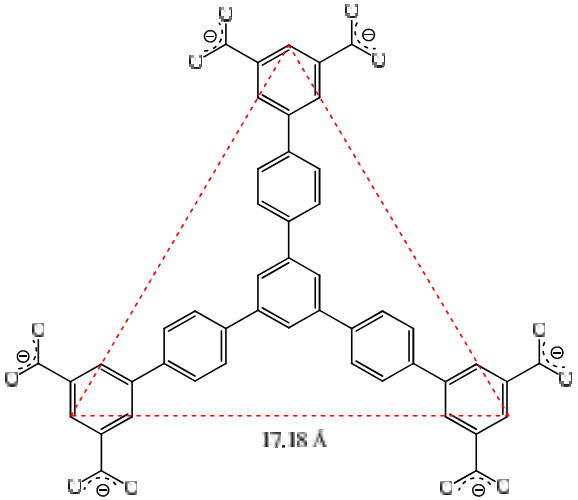
NOTT MOFs

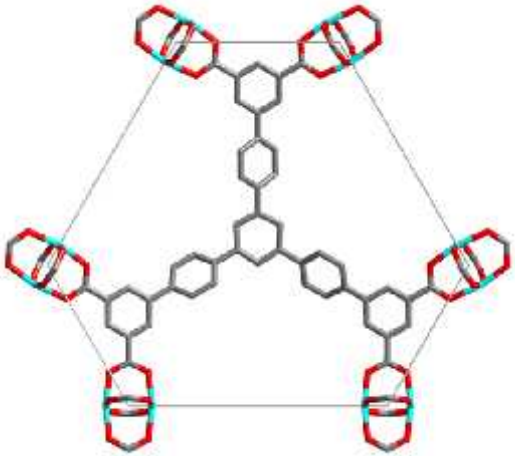


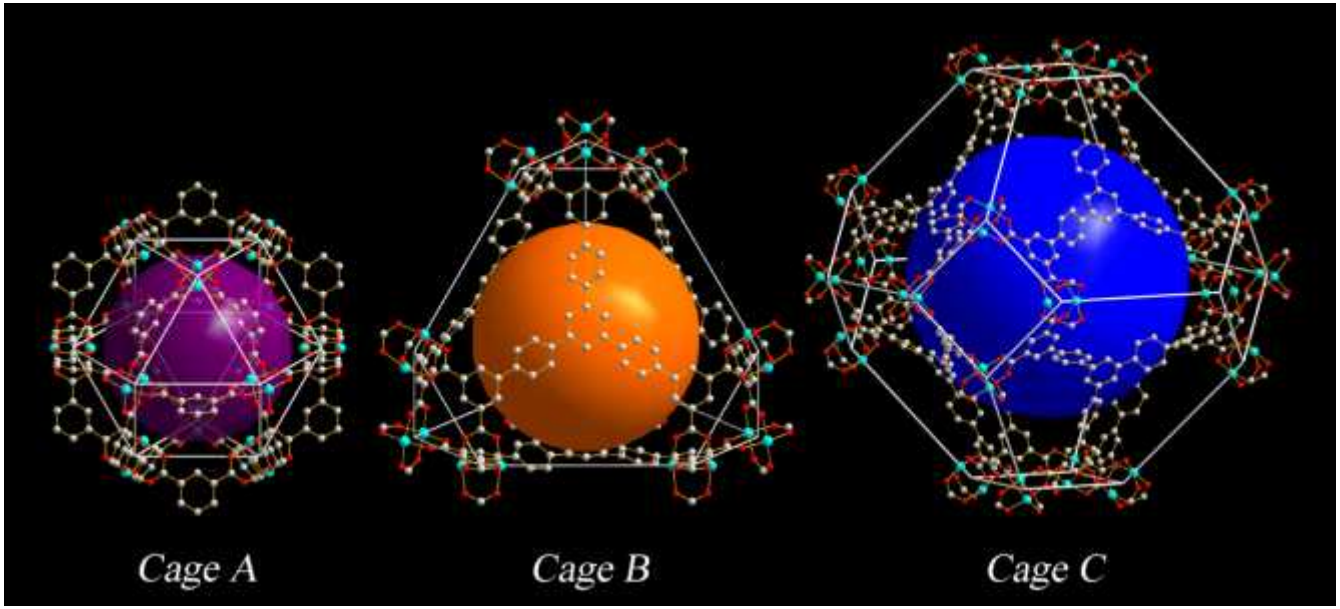
	H_2 uptake (1 bar/20 bar) (wt%)	Maximum uptake from Langmuir plot (wt%)	Maximum H_2 volumetric uptake (g/L)
1	2.59/4.02	4.20	38.9
2	2.52/6.06	6.70	43.6
3	2.24/6.07	7.01	41.1

2010 DOE guidelines: 6wt% H_2 storage capacity 45 g/L volumetric capacity

NOTT MOFs







10.0 wt% at 77 bar. Volumetric storage density 50.3 gL^{-1}

NOTT MOFs

The University of Nottingham

The University of Nottingham

EPSRC Engineering and Physical Sciences Research Council

SUPERGEN

GM

The Leverhulme Trust

THE ROYAL SOCIETY

Thank you

Neil.Champness@nottingham.ac.uk