YUTO TAKAGI Ph.D., P.Eng.

Product Development Manager, SOFC, Conductive Ceramics, Saint-Gobain

- Short Introduction
  - Dr. Takagi is a SOFC product development manager at Saint-Gobain, responsible for managing its major projects as well as driving the direction of its R&D portfolio.
  - As a part of his responsibilities, he works closely with diverse global companies involved in the energy and engineering field.
  - Before joining Saint-Gobain in 2014, he worked for SONY and Ebara Ballard, where he was responsible for variety of fuel cell system integration and critical component developments.

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SAINT-GOBAIN, ONE OF THE WORLD'S TOP LEADING INDUSTRIAL CORPORATIONS WITH 350 YEARS OF HISTORY

top EMPLOYER GLOBAL 2017
CERTIFIED EXCELLENCE IN EMPLOYEE CONDITIONS

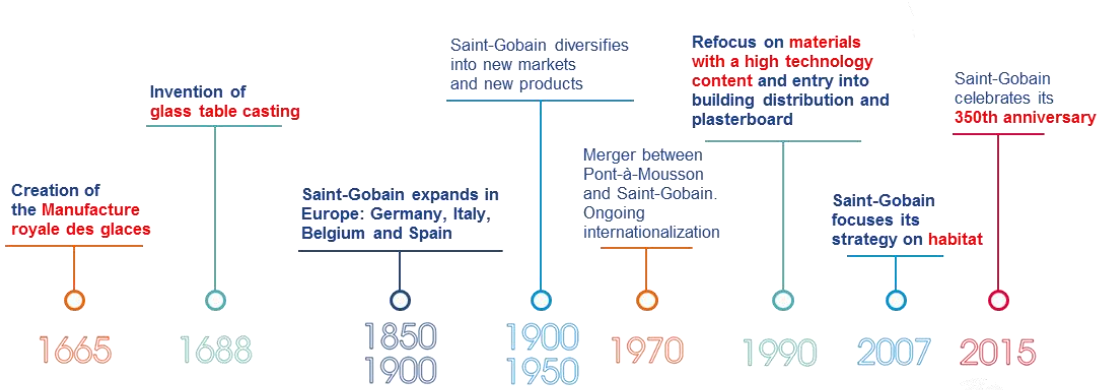
Operations in **66 countries**

Over **170 000** employees

2016

Amounts in €bn

Sales	39.1
Operating income	2.8
Recurring net income	1.4



R&D in Saint-Gobain

8 cross-business R&D centers

3,700 people

One of the top **100** global innovators*

* *Source: Thomson Reuters*

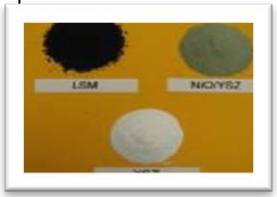
CERAMIC MATERIALS

SAINT-GOBAIN

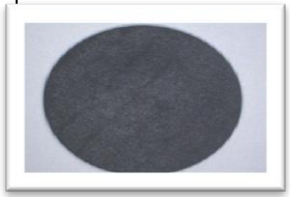
SOFC DEVELOPMENT HISTORY AT SAINT-GOBAIN

Internally funded for 10 years with external collaborations

2005
Internal project started, material and process development

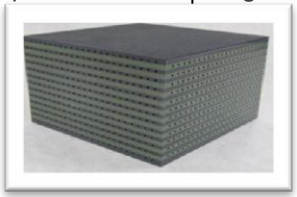


2006
Co-sintered button cell with OCV > 1.0V



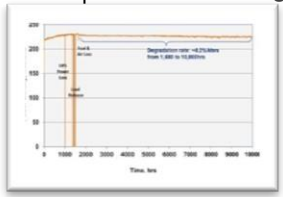
2009
'Button Stack' developed with all relevant features

2010-2011
Scale-up, performance and degradation improvements

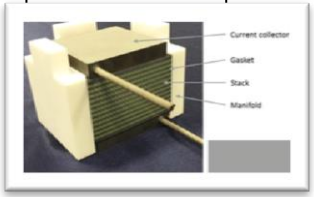


2012
150W stack developed, internal testing begins

2013
Degradation rate of 0.2%/khr demonstrated; Public unveiling

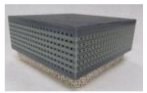


2014
150W module for testing developed



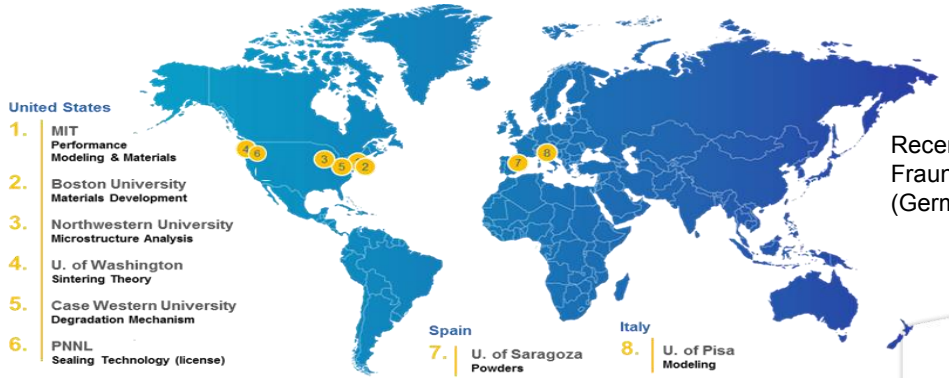
2015
Industrial style 150W module development

Northboro, MA



Stack Development & Testing

Collaboration Partners

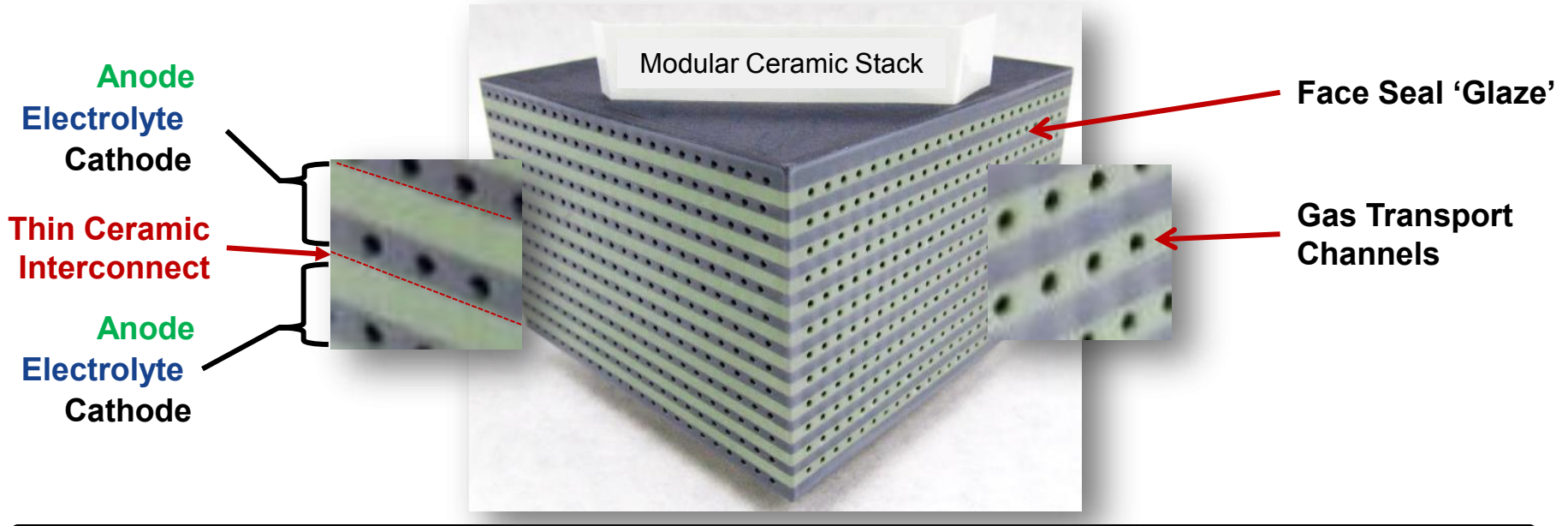


Recent addition : Fraunhofer IKTS (Germany)

CERAMIC MATERIALS

SAINT-GOBAIN

INNOVATIVE SG ALL-CERAMIC SOFC STACK



Key Differentiators

1 High Durability & Reliability

Thin ceramic interconnects
Well bonded interfaces

2 Low Cost Manufacturing & System

Multi-cell co-firing
Multi-layer processing

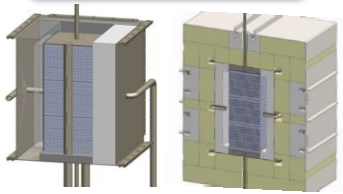
3 Compact Design

Good volumetric power density

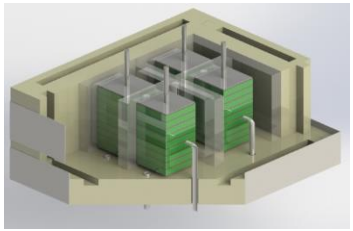
VALUE CHAIN FOR MARKET APPROACH AND SG'S POSITION

From Powder, Stack to Hot box

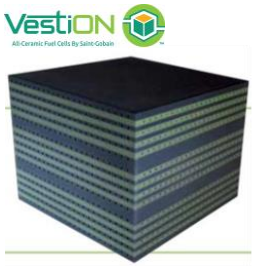
600W Module



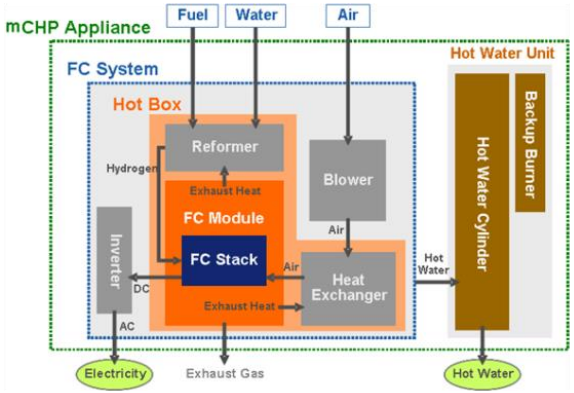
2.5 kW Module



Stack/Module Saint-Gobain



System Partner



Utility/Distribution

Powder → Cell → Stack → Module → Hot Box → System Integration → Appliance → Utility/ Distribution

SG domain