



SOLVAY

asking more from chemistry®



SOLKANE®



SOLKANE® 365

Around the World with Solar Impulse

Introduction

Solvay became Solar Impulse's first main partner in 2004. It is also the technology partner providing its recognized competence in material developments and applications. A pioneering spirit coupled with ecological challenges, with positive and practical awareness of sustainable development, are the drivers for the search for alternatives to non-renewable resources.

Solar Impulse is a solar powered airplane designed to fly around the world at any time – day or night. The purpose is to address sustainable challenges of today with the focus on the use of renewable energy. Innovation and technology are essential to achieve results. The Solar Impulse prototype HB-SIA made its continuous first 26 hours flight on 7 July 2010. In 2012, the Solar Impulse plane performed intercontinental flight. Solar Impulse HB-SIB, the upgraded second version of the solar airplane that will begin its world tour in early 2015 without using a single fuel drop.

The Main Characteristics of the Solar Impulse HB-SIB

Wingspan	72 m
Engines	4 x 10 HP
Average flying speed over ground	70 km/h
Maximum altitude	12,000 m
Weight	2,300 kg
GWP	1

SOLKANE® 365 for Polyurethane Foams

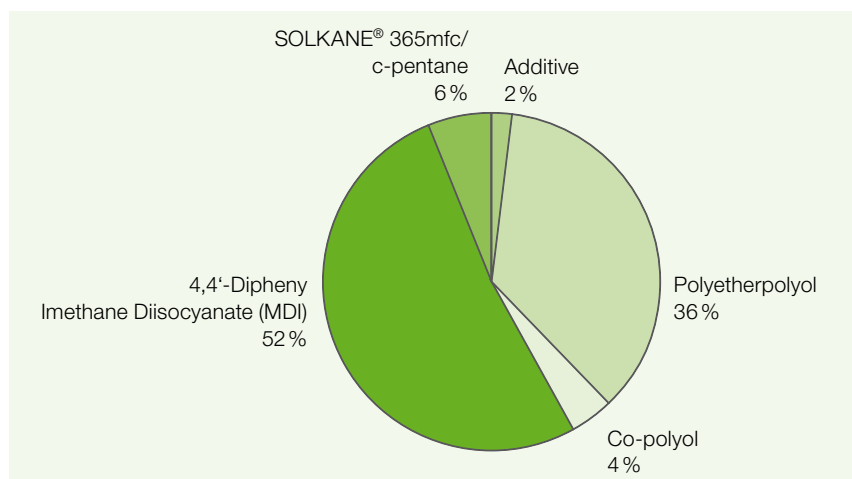
The design of the Solar Impulse cockpit must be lightweight and mechanically stable. The cockpit should maintain ambient temperature despite the variable outside temperatures ranging from -56°C to 130°C . The choice of polyurethane foam (PU-F) meets those technical requirements. PU-F is produced from a polyol, an isocyanate and a foam blowing agent.

Two different blowing formulations were compared for the production of the PU-F. The thermal conductivity (λ -value) of the PU-F obtained from c-pentane (cP) was worse than the λ -value obtained from a co-blowing formulation i.e. c-pentane/SOLKANE® 365. This better result of the co-blowing formulation will limit the thickness of the insulation material and should justify the higher price of SOLKANE® 365.

Besides insulating properties, the PU-F formulation is also designed to compensate the stress in the PU-F when exposed to the huge temperature differences. Dimensional stability of the foam matters to maintain its dimensions, to avoid fracture or to avoid losses of attached fixtures. SOLKANE® 365 was used to produce the polyurethane foam (PU-F) for the cockpit of the Solar Impulse plane. The PU-F has the following outstanding properties:

- Best foam insulation values
- Best foam dimensional stability
- Best foam compressive strength

Formulation of the PU-F (by weight in %)



Foamed Cockpit Insulation



High performance polyurethane cockpit foamed with 365mfc/cP blowing agent blend to assure

- maximum insulation
- with maximum strength
- at lowest possible weight

Optimisation with SOLKANE® 365 Co-blowing

Parameter	Unit	Results	
		SOLKANE® 365mfc + c-Pentane	c-Pentane
Density variation (lower – middle – upper)	[kg/m ³]	28.2 – 25.5 – 28.5	27.8 – 26.0 – 28.2
Dimensional stability (2 days, 70 °C, 95 % relative humidity)	[%]	-0.6/-0.3/0.2	0.2/-0.1/0.7
Dimensional stability (28 days, 70 °C, 95 % relative humidity)	[%]	3.6/1.9/1.0	1.2/1.7/0.8
Dimensional stability (7 days, RT)	[%]	-0.6/-0.2/0.2	-0.1/-0.9/0.7
Dimensional stability (24h, -22 °C)	[%]	-0.1/0.0/0.0	0.0/-0.2/0.2
Dimensional stability (24h, 100 °C)	[%]	-0.1/-0.3/0.0	-0.1/-0.2/-0.2
Dimensional stability (24h, -40 °C)	[%]	-0.2/0.0/-0.1	-0.1/0.0/-0.2
Closed cells	[%]	98	97
Thermal conductivity (DIN 12667)	[mW/mK, initial]	19.5	22.3
Compressive strength II (E-Modul)	[MPa/MPa]	0.164/4.59	0.145/4.3
Compressive strength -I-1 (E-Modul)	[MPa/MPa]	0.065 dB 0.063 d10/1.79	Not available
Compressive strength -I-2 (E-Modul)	[MPa/MPa]	0.103/2.97	Not available

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