



Our Vision

3M Technology Advancing Every Company

3M Products Enhancing Every Home

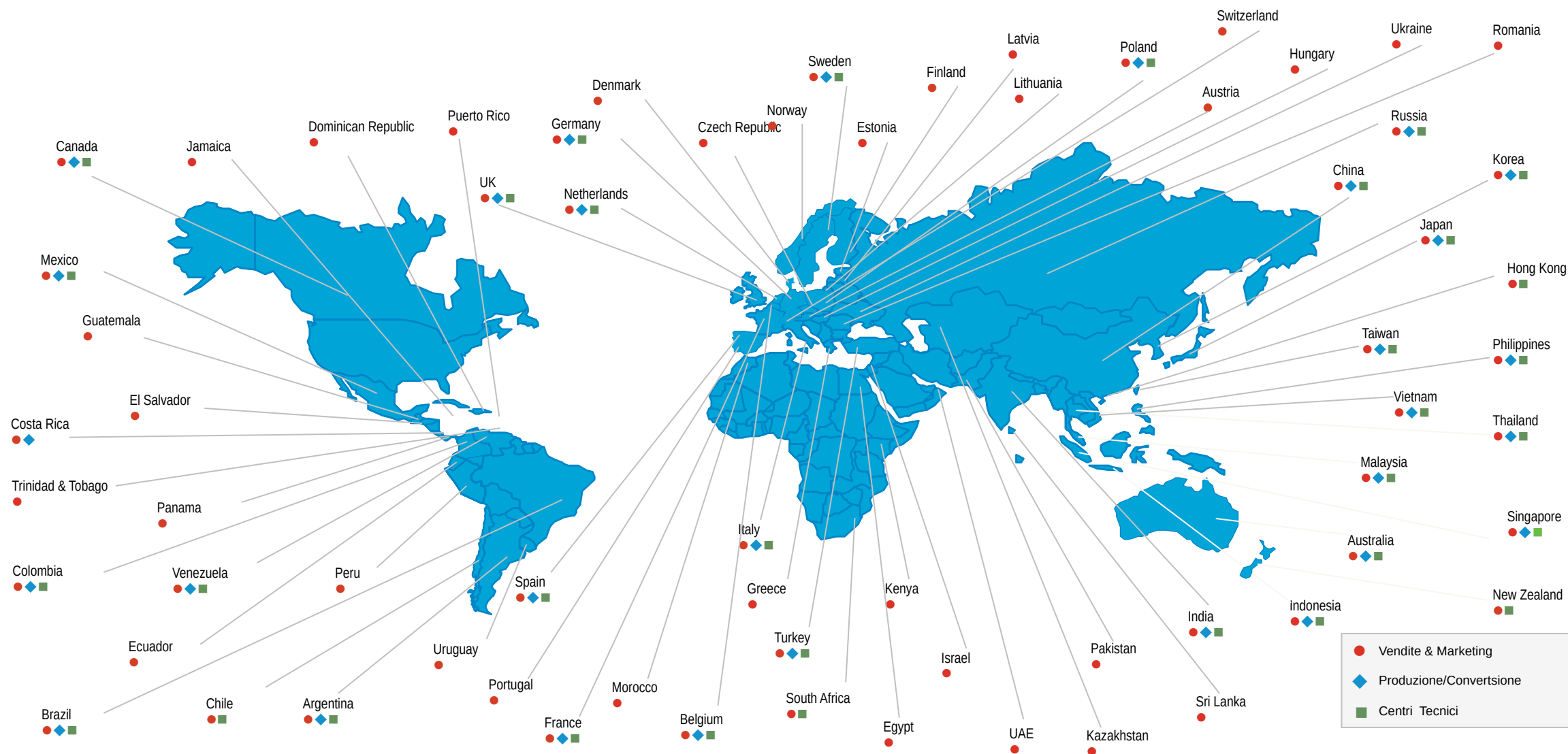
3M Innovation Improving Every Life



3M fa parte dell'Indice Dow Jones



Continua Crescita della Presenza Globale



Crescita Globale

- 
- Vendite Globali: \$31 Miliardi
 - 64% delle vendite realizzate al di fuori degli US
 - Una delle 30 Società dell'Indice Dow Jones
 - 89.000 dipendenti
 - Vendite in 200 Paesi
 - Sedi in 70 paesi
 - 5 Business Areas

- 37 Laboratori internazionali
- 40 Customer Tech Centers
- Tech Service in 60 Paesi

47 piattaforme tecnologiche
6% del fatturato annuo in R&D
100.000 Brevetti Registrati, 1400 italiani
7350 ricercatori nel mondo

3M



Nexcare
PRODUCTS



Scotch



Post-it
Brand



SCOTCHGARD



Command
BRAND
STRIPS



FUTURO
Products



Scotch-Brite



Filtrete



Thinsulate
INSULATION
3M

3M

Forse non lo sai....



ma oggi
ci siamo incontrati

almeno 20 volte

3M



Consumo





Salute







Industria

3M Italia

Carpiano



Malaspina Park-Pioltello



Grassobbio



Marcallo



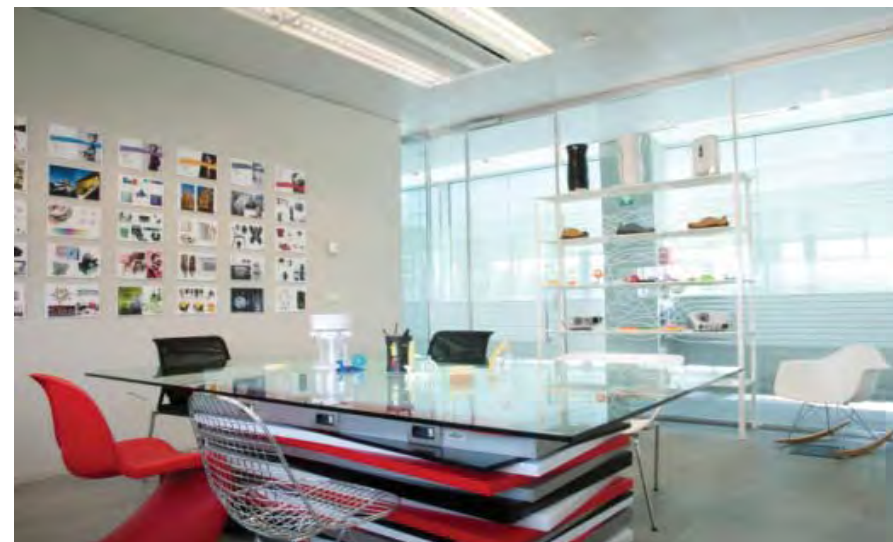
Predosa



Rome – Via del Tritone



NEW Customer Innovation Center



European Design Lab, area Consumo



Customer Technical Center a Carpiano per le Tecnologie abrasive

3M HQ Malaspina: icona dei nostri valori



Caratteristiche HQ Malaspina

Energia verde:

- Architettura Eco-sostenibile (Progetto Mario Cucinella Architects)
- Eco-compatibilità: impianti geotermico e fotovoltaico
- Colonnine munite di pannelli fotovoltaici per ricaricare le auto elettriche

Comfort ambientale:

- Nuovo concetto di spazi lavorativi
- Sede European Design Lab
- Facilities per dipendenti
- Posti auto riservati alle donne incinte
- Spogliatoi e docce per i dipendenti

Aperti ai clienti:

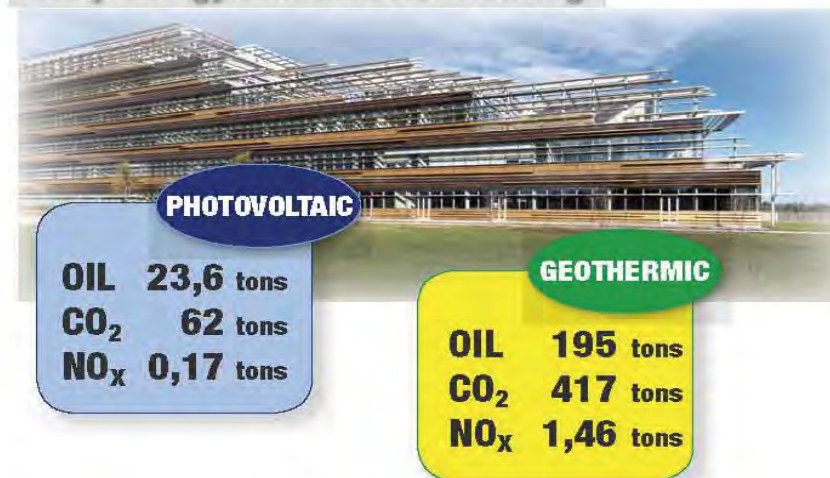
- Tecnologie e Materiali innovativi
- Utilizzo di 33 Prodotti 3M
- 3M Store
- Customer Innovation Center e CTC

Awards:

- US Architectural Award
- MIPIM Award in the Green Buildings Category
- Premio Innovazione Amica dell'Ambiente - Legambiente
- Recognition at Enel Solar exhibition within Best Practice Projects – Politecnico di Milano

Eco Building Malaspina

Yearly energy and emissions savings



mipim
awards

**ENERGY SAVING:
1.500.000 Kwh**

RENEWABLE
ENERGY FROM
PUBLIC NETWORK

NON RENEWABLE
ENERGY

PHOTO

GEO

RENEWABLE
ENERGY PRODUCED
AT 3M SITE

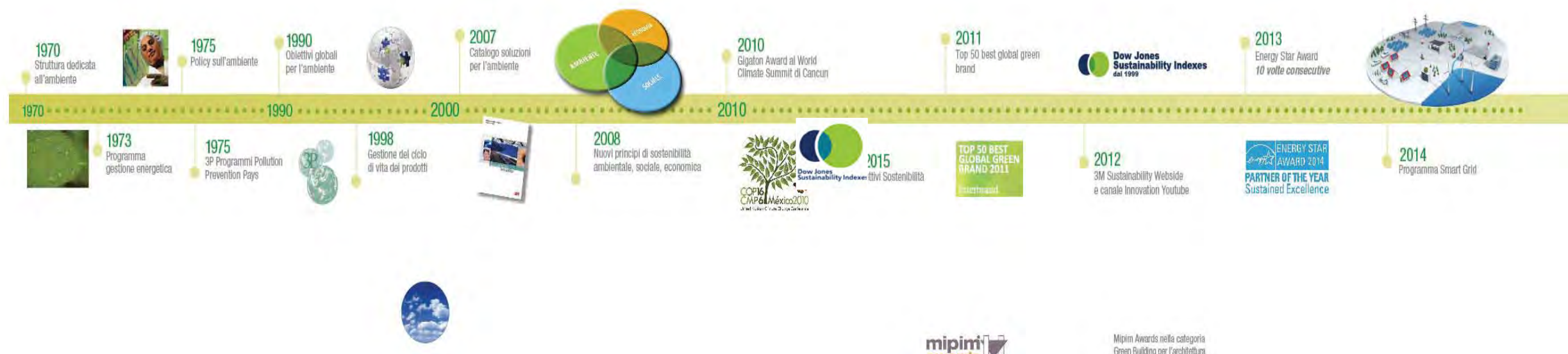
OIL: energy equivalent to oil tons

CO₂: main factor for ambient temperature increase

NO_x: nitrogen's oxides main cause for acid rains

Risultati globali per l'ambiente

- Energy Star Award ottenuto per il decimo anno consecutivo
- 438 progetti 3P “Pollution Prevention Pays” hanno evitato:
 - Oltre 50 milioni di Kg di inquinamento
 - 2,5 milioni di tonnellate di emissioni di gas ad effetto serra di CO₂ equivalente
 - 91 milioni di dollari di spreco energetico



Idee che si Collegano Attraverso Diverse Tecnologie



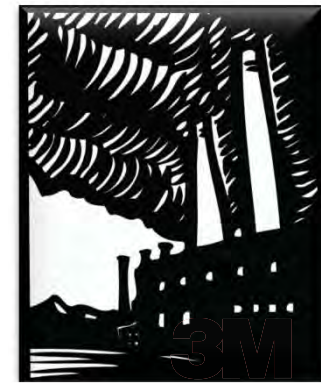
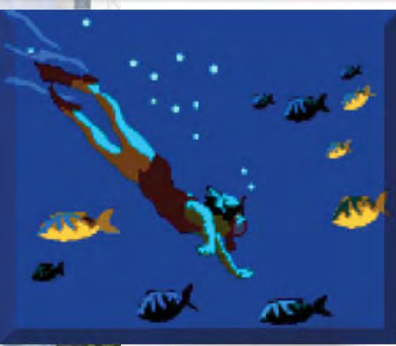
Ab Abrasives	Bi Biotech	Em Electronic Materials							Pm Polymer Melt Processing	Sm Specialty Materials
Ac Acoustics	Ce Ceramics	Es Electronics & Software						Nt Nano-technology	Po Porous Materials & Membranes	Su Surface Modification
Ad Adhesives	Dd Drug Delivery	Fc Flexible Converting & Packaging					Mi Microbial Detection & Control	Nw Nonwoven Materials	Pp Precision Processing	Tt Track & Trace
Am Advanced Materials	Di Display	Fe Flexible Electronics	Fs Filtration, Separation, Purification	Is Integrated Systems & Design	Me Metal Matrix Composites	Mo Molding		Op Opto-electronics	Pr Process Design & Control	Vp Vapor Processing
An Analytical	Do Dental & Orthodontic Materials	Fi Films	Im Imaging	Lm Light Management	Mf Mechanical Fasteners	Mr Micro-replication		Pd Particle & Dispersion Processing	Rp Radiation Processing	We Accelerated Weathering
As Application Software	Ec Energy Components	Fl Fluoro-materials	In Inspection & Measurement	Md Medical Data Management				Ec Energy Components	Se Sensors	Wo Wound Management

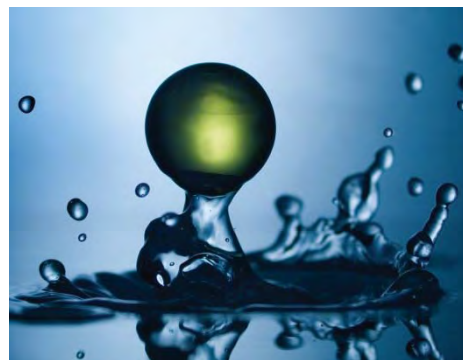
3M Advanced Materials Division : I Megatrend



Smarter Better
Products







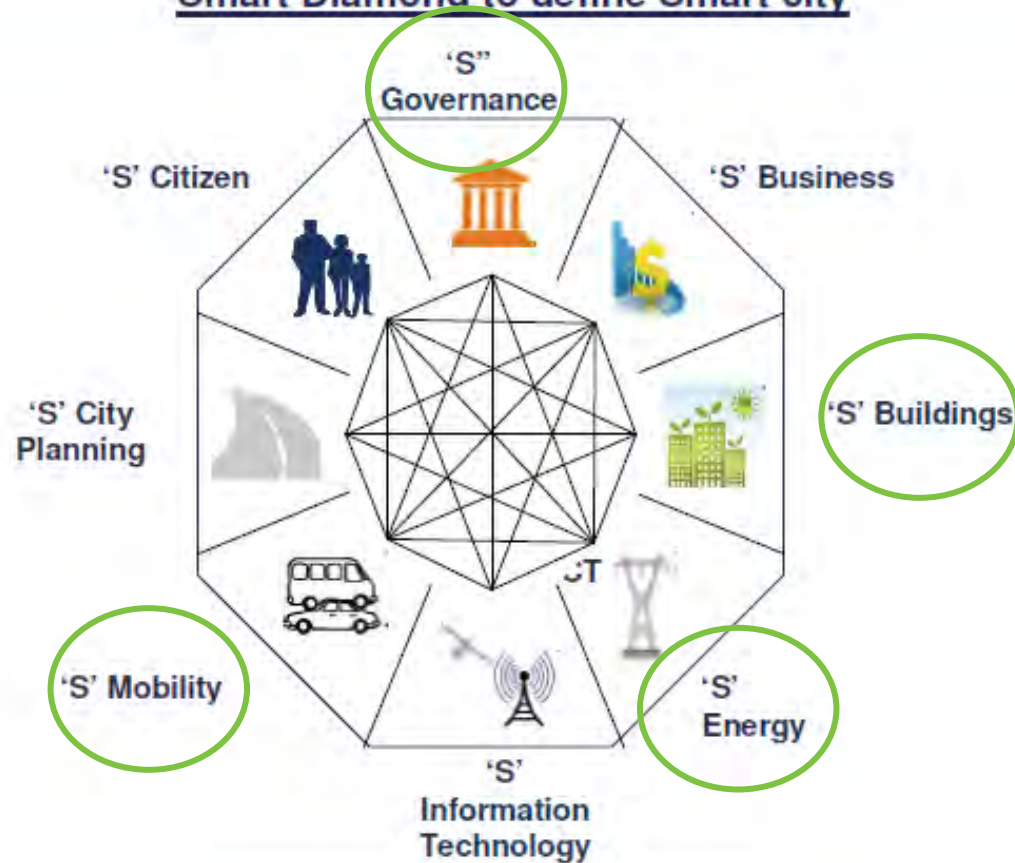
Megatrends

- Megatrends are higher-level trends that are industry and region independent (usually).
- They can fundamentally change the direction of how value is perceived or even measured.
- Many people don't think about the trends that are going to affect their future before they are forced to deal with them. Yet many of these trends can be seen far off on the horizon.
- I think about the future, I start with megatrends, then move to IT trends and their support of business impact and then finally thinking about the alignment of technology and business at a more operational level. Although there are many ways to think about what can happen, this more structured approach is repeatable.

Megatrend

Smart Cities – “Green” Replaced by “SMART” Concepts

Smart Diamond to define Smart city

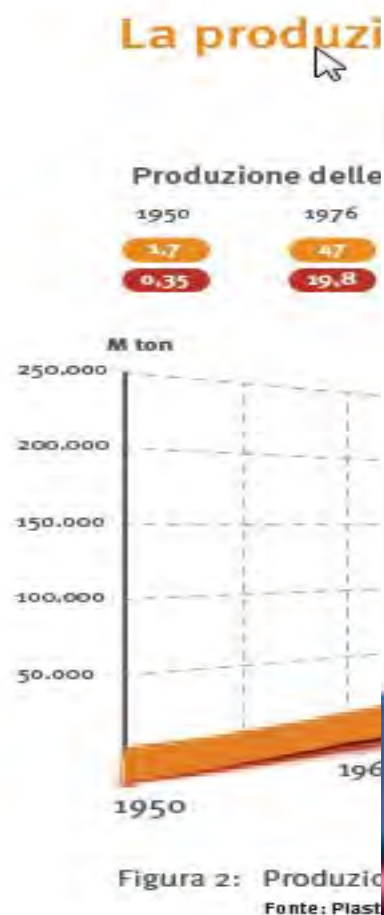


Source: Frost & Sullivan

Sustainable Material for Lightweighting & Energy Saving

- 
- Lightweight Plastic material (PP, PA, ABS, TPO.....)
 - Lightweight Composit materials (Resins, Simil wood.....)
 - Produce Interior Paint with thermal inshulation capability
 - Produce Exterior Paint with thermal inshulation capability

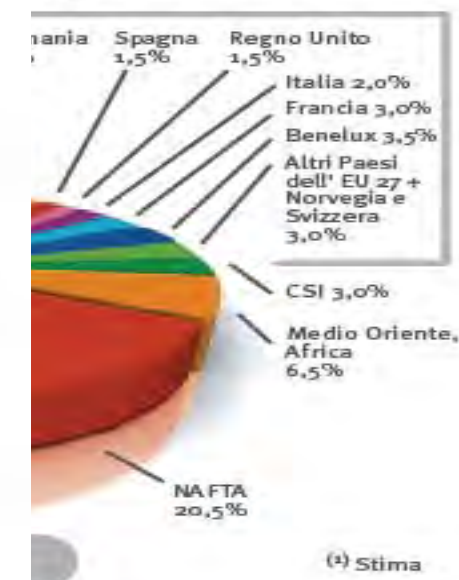
Analisi Mercato : Produzione mondiale polimeri plastici 265 Milioni di Tons: Italia = 2% pari a 5,3 MTons



Europa (Occidentale + Centrale)
21,5% 57 M ton⁽¹⁾

**Italia = 2% Mercato Globale
e circa 10% mercato
Europeo
= 5,3 M Tons**

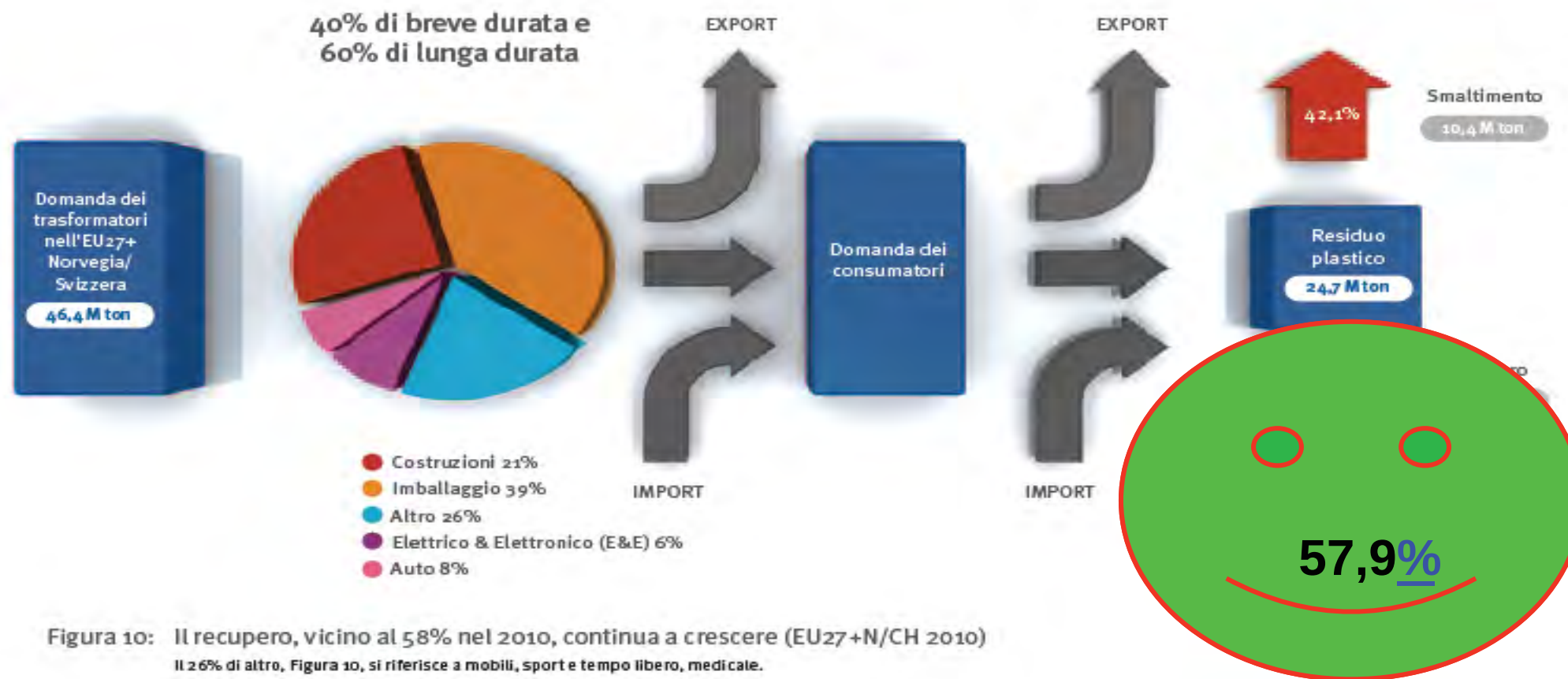
ia (Occidentale + Centrale)
5,57 M ton⁽¹⁾



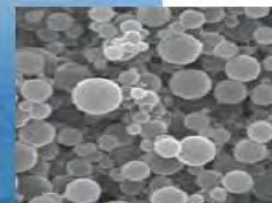
terie plastiche 2010
arch Group (PEMRG)

Source : PEMRG

La filiera della Plastica : Domanda -Consumo - Smaltimento



Ma anche



.....tanto altro ancora !



3M™ Glass Bubbles iM16K

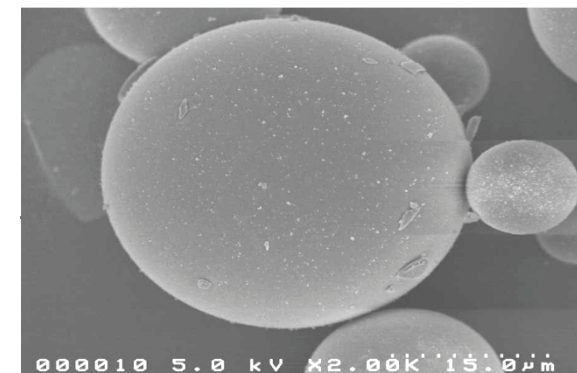


3M

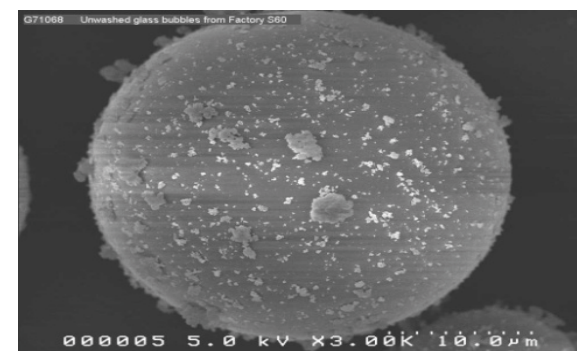
3M™ Glass Bubbles iM16K

Property	Value
Shape	Hollow, thin walled, unicellular spheres
Composition	Soda-lime borosilicate glass; Chemically stable and water resistant glass
Color	White
Density	0.46 g/cc
Crush Strength	16,500 psi
Hardness	Mohs scale 5
Softening Temp	600°C
Average Diameter	20 microns

Properties Not For Specification Purposes

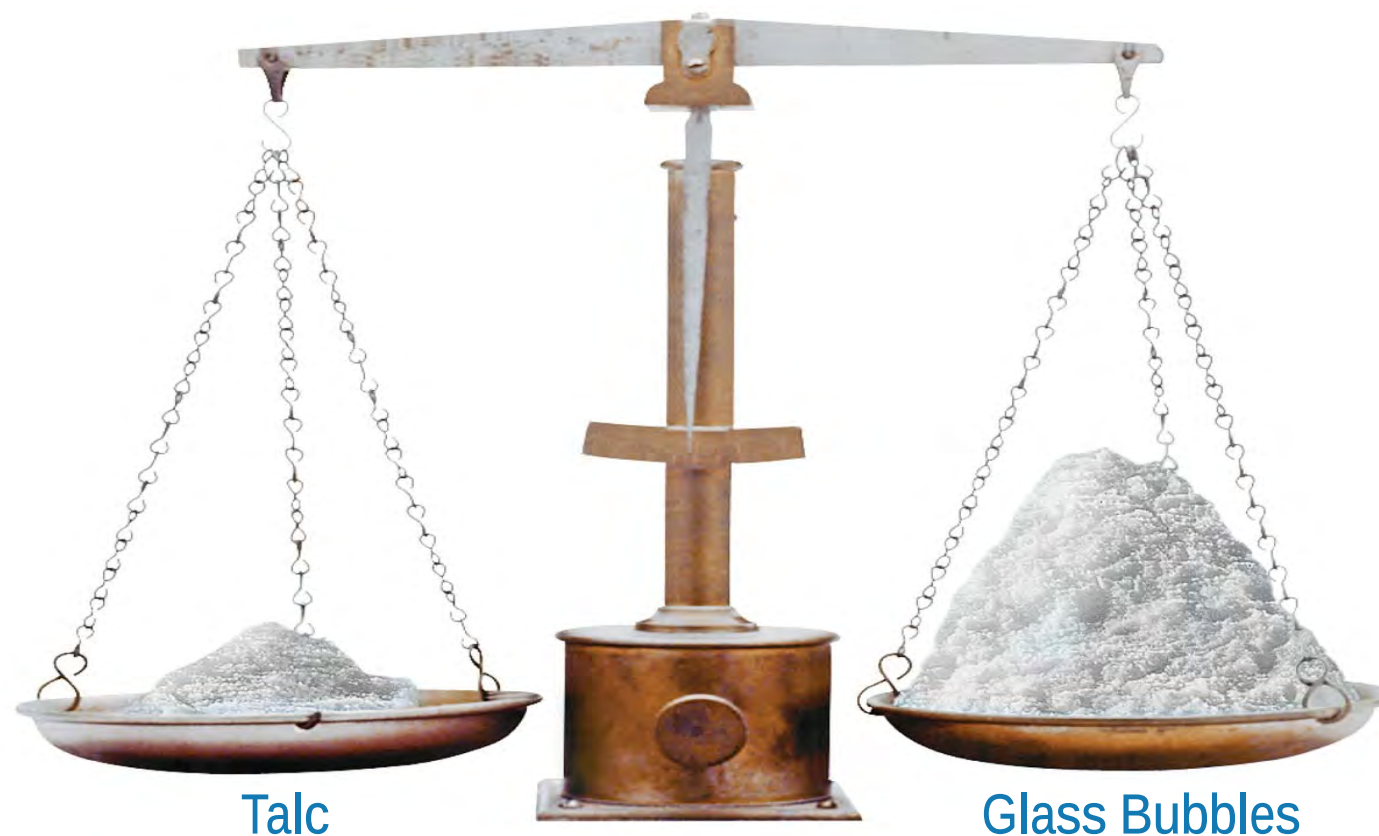


Glass Bubbles as made



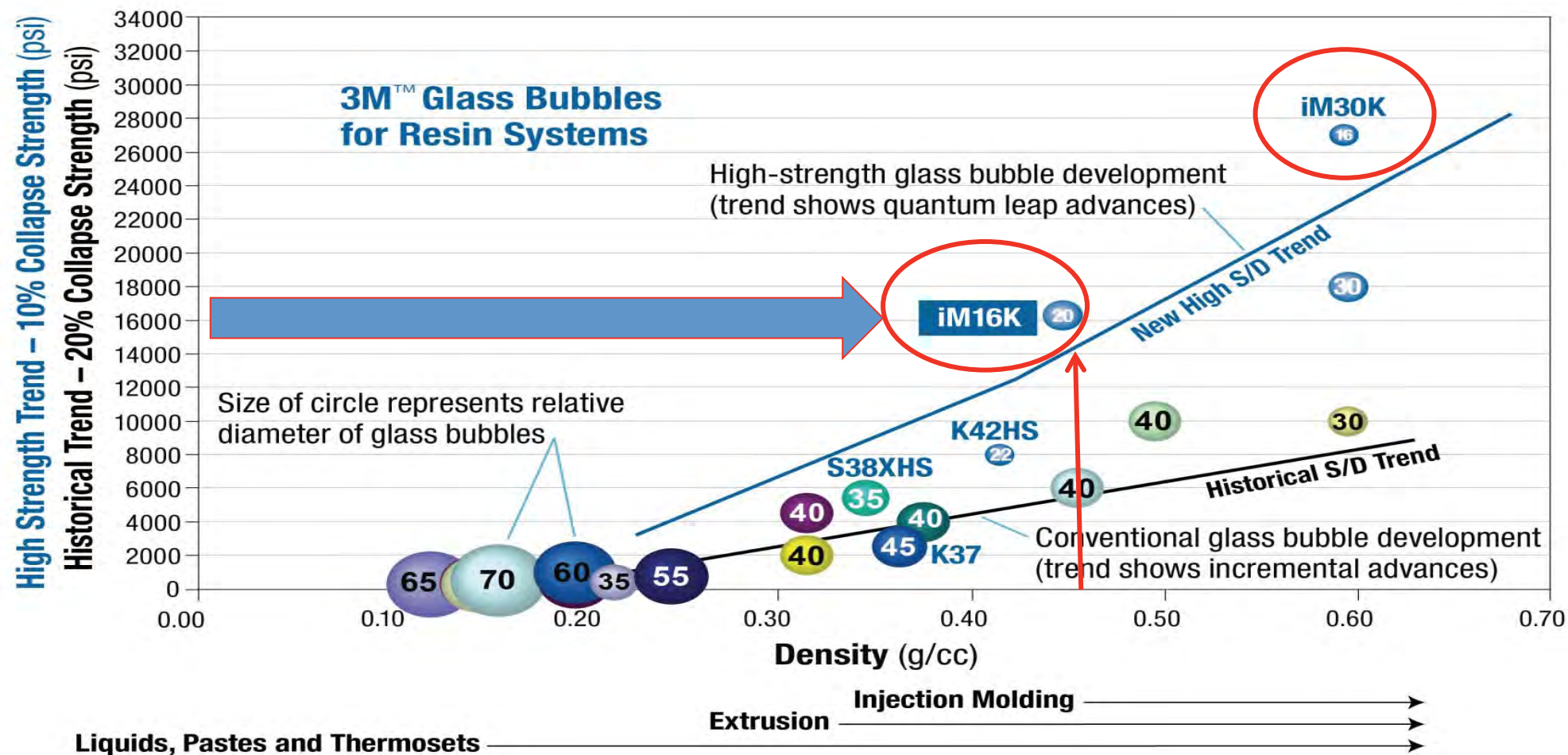
Glass Bubbles with silica anti-caking agent on surface

3M™ Glass Bubbles and Other Additives



Glass bubble volume is considerably different when compared to an equal weight of higher density mineral fillers.

3M™ Glass Bubbles Strength to Density Map



3M™ Glass Bubbles and Other Additives

Classified by Aspect Ratio

Rod or Fiber

Asbestos/Glass Fiber/Wollastonite



Platelet

Mica/Talc/Delaminated Clay



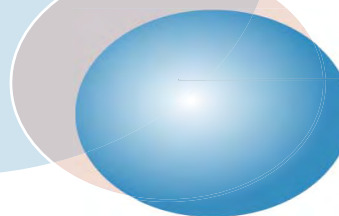
Nodular

Calcium Carbonate/Ground Silica



Sphere

Solid/Thin Walled/Thick Walled



Sphere offers lowest surface area to volume ratio of any other plastic additives

High Strength Glass Bubbles Portfolio

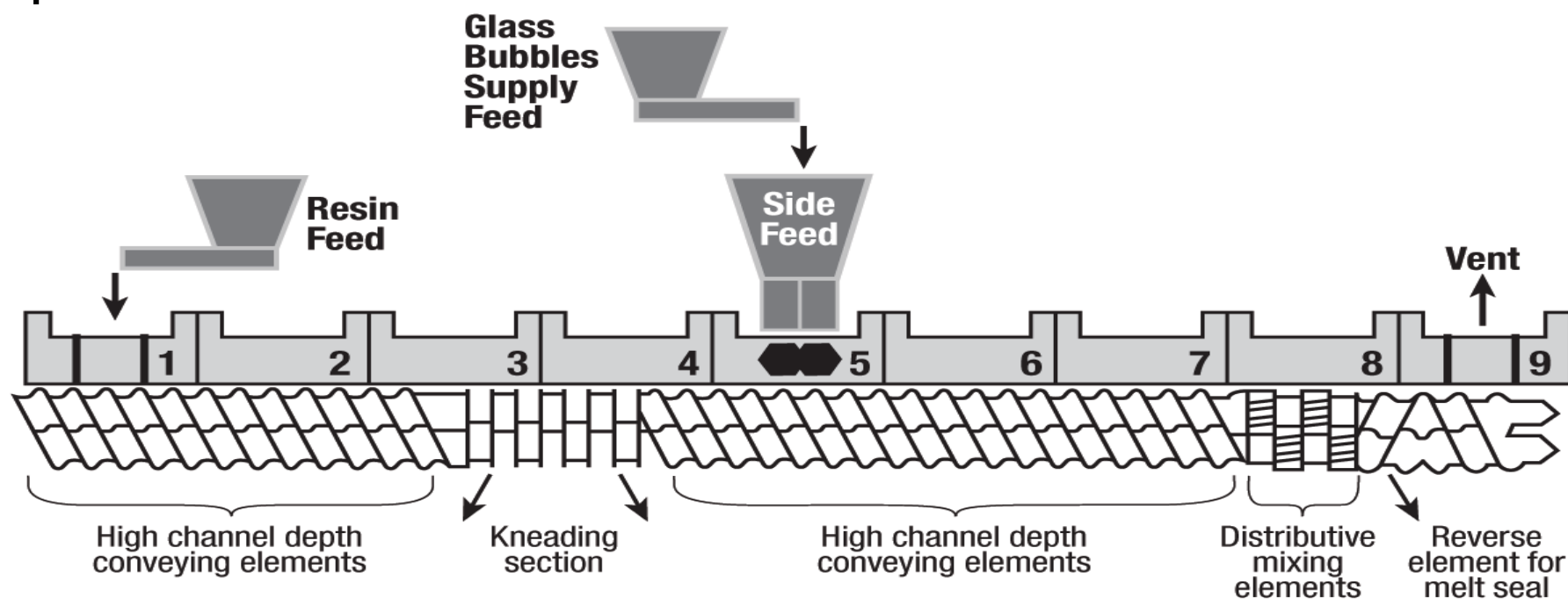


3M GLASS BUBBLE	DENSITY g/cc	Strength psi	PARTICLE SIZE (microns)				AVG. WALL THICKNESS microns	VOL. % GLASS	VOL. % GAS
			10 % <	50 % <	90 % <	TOP			
K37	0.37	3000	20	40	80	85	1.04	15%	85%
S38	0.38	4000	15	48	75	85	1.28	15%	85%
S38HS	0.38	5500	17	45	66	83	1.20	15%	85%
K46	0.46	6000	15	40	70	80	1.31	18%	82%
K42HS	0.42	7500	11	22	37	42	0.65	17%	83%
S60	0.60	10000	15	34	55	65	1.49	24%	76%
iM16K*	0.46	16500	13	22	31	37	0.72	18%	82%
S60HS	0.60	18000	11	30	50	60	1.09	24%	76%
iM30K	0.60	30000	9	16	25	29	0.70	24%	76%

Surface enhancement options available for glass bubbles

* Final Specifications are subject to change

Incorporation of 3M™ Glass Bubbles via Twin Screw Extrusion



- Add glass bubbles downstream into fully molten polymer to minimize breakage
- After addition use high channel depth conveying elements
- Feeding into kneading block or conveying element with low channel depth will increase breakage

(Optional)

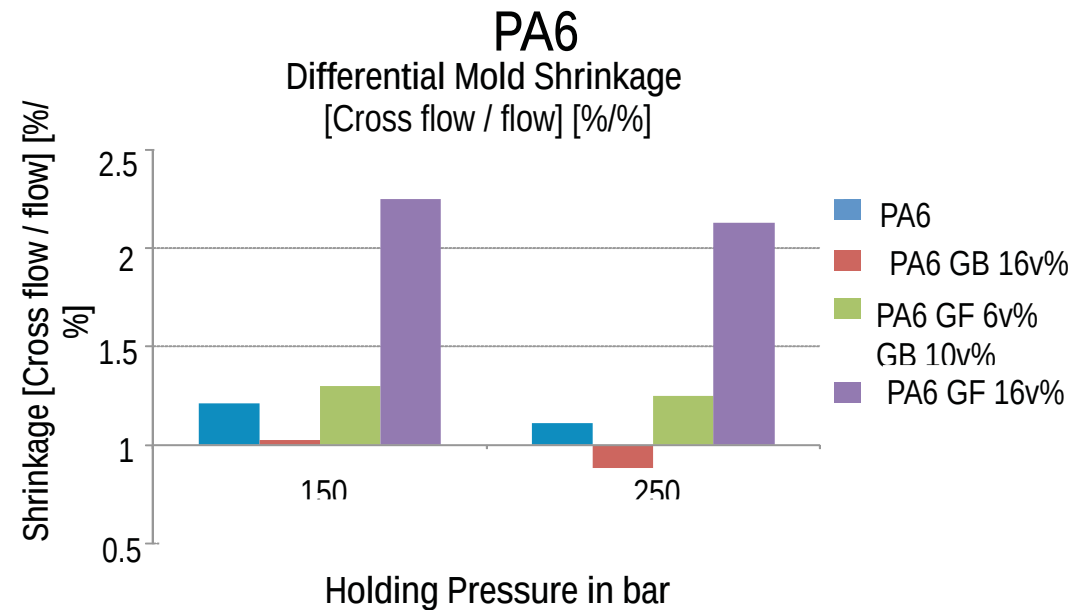
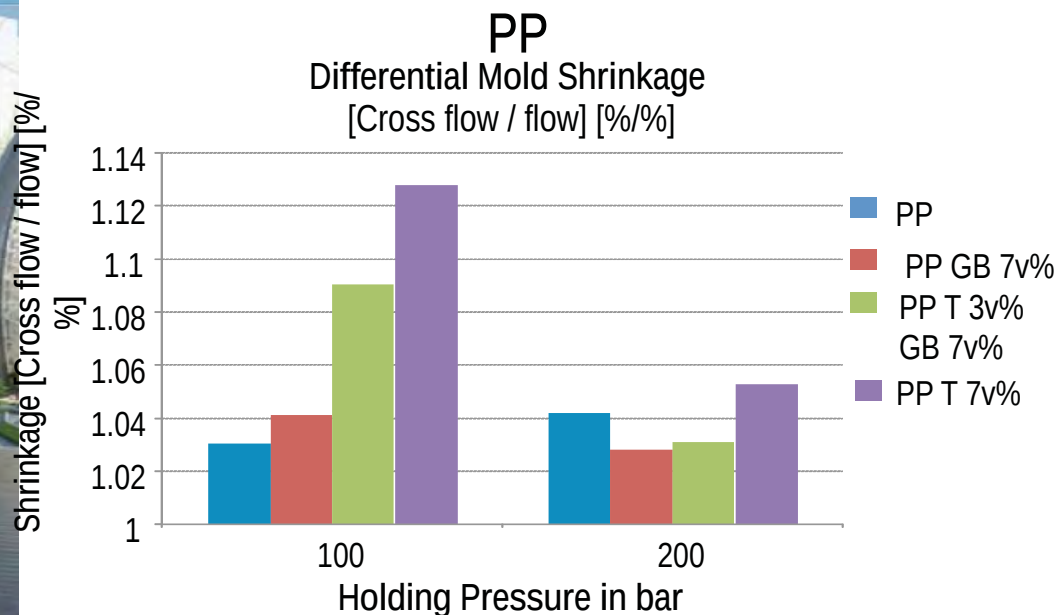
Theoretical Weight Reduction of 3M™ Glass Bubbles in Unfilled Resins

Glass Bubbles	Volume %	Polypropylene 0.9 g/cc		Polyamide 1.14 g/cc		PEEK 1.32 g/cc	
		Weight Loading %	Weight Reduction %	Weight Loading %	Weight Reduction %	Weight Loading %	Weight Reduction %
S60HS	10	6.9	3	5.5	5	4.8	6
iM16K	10	5.4	5	4.3	6	3.7	7
S60HS	20	14.3	7	11.6	10	10.2	11
iM16K	20	11.3	10	9.2	12	8	13
S60HS	30	22.2	10	18.4	14	16.3	16
iM16K	30	18	15	14.7	18	13	20

Dimensional Stability in PP and PA6

Independent Study by SKZ Institute, Germany

According to DIN EN ISO 294-4



Improve dimensional stability of molded parts by decreasing differential mold shrinkage with iM16K

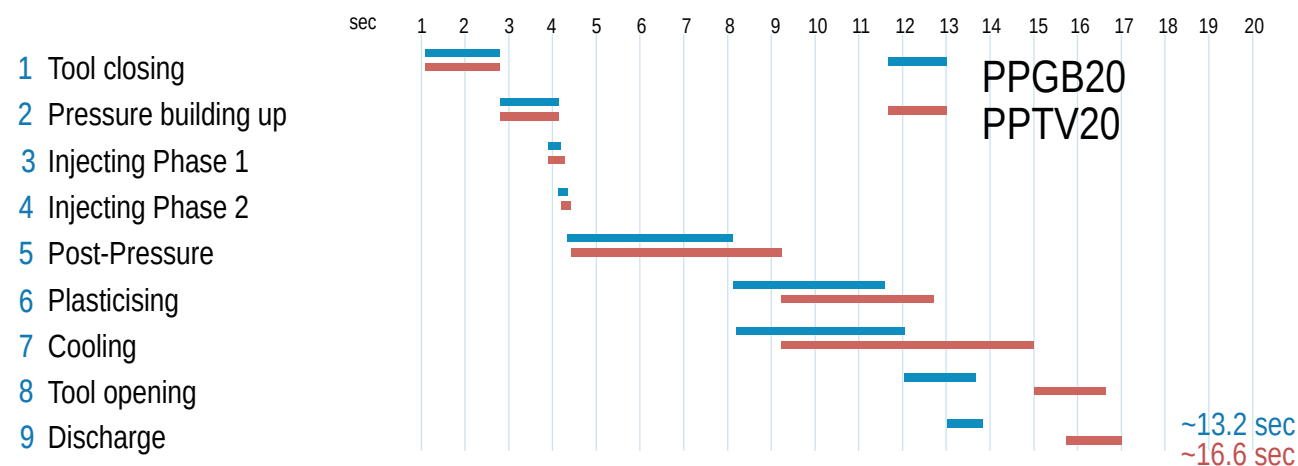


Injection Molding Cycle Time Reduction in PP

3M Cabin Air Filter Frame Containing 3M™ Glass Bubbles iM30K

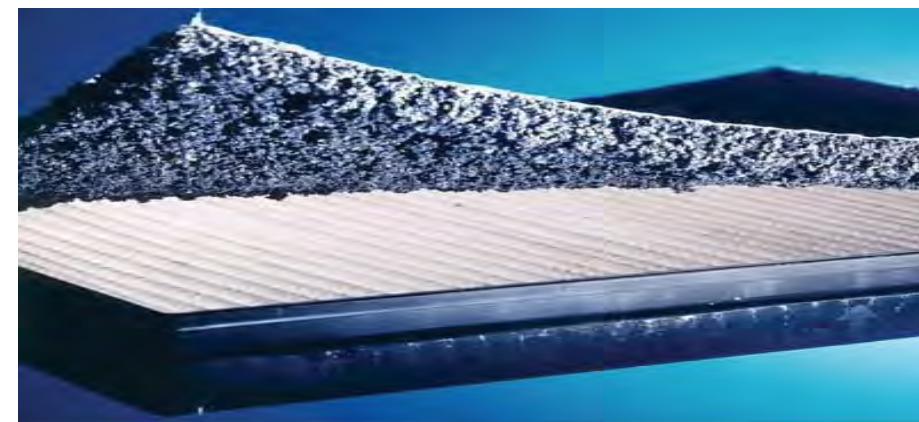
Criteria	Target	PPTV20	PPGB20	D
Density (g/cc)	1.04	1.043	0.846	- 18.8 %
Length (mm)	258	257.41	258.07	- 0.59
Width (mm)	193	192.38	192.99	- 0.61
Height (mm)	30	30.07	30.02	- 0.05
Part Weight (g)	64	64.08	53.32	- 16.8 %

Molding Process for 3M CAF frames E-39



Starting formulation: PP + 20wt% talc + carbon black (PPTV20A15)

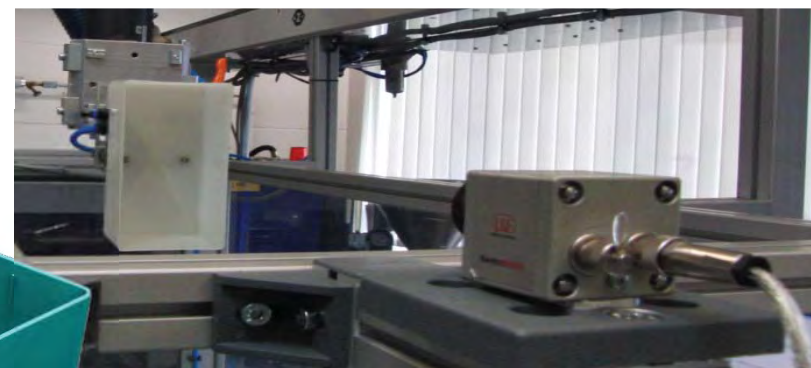
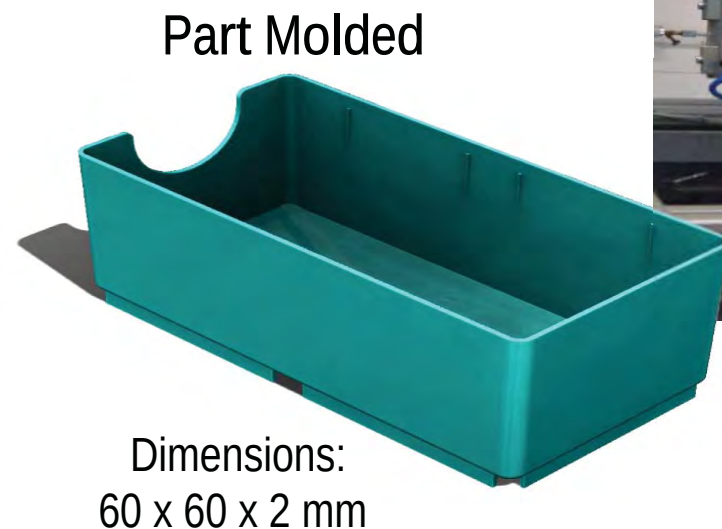
GB formulation: PP + 5wt% (=20wt.% talc) 0.6 g/cc GB + carbon black (PPGB20)



Injection Molding Cycle Time Reduction in PA6 Containing iM16K

Independent Study by SKZ Institute, Germany

Material	Total Cycle Time t_G [s]	Cycle Time Reduction in [%]
PA6	40.2	–
PA6 GB–16 v%	35.2	12
PA6 GF 15–6 v% GB–10 v%	38.2	5



Experimental Setup:
Ejection Temp measured by IR

3M™ Glass Bubble Applications



Contributing to Environmental Sustainability

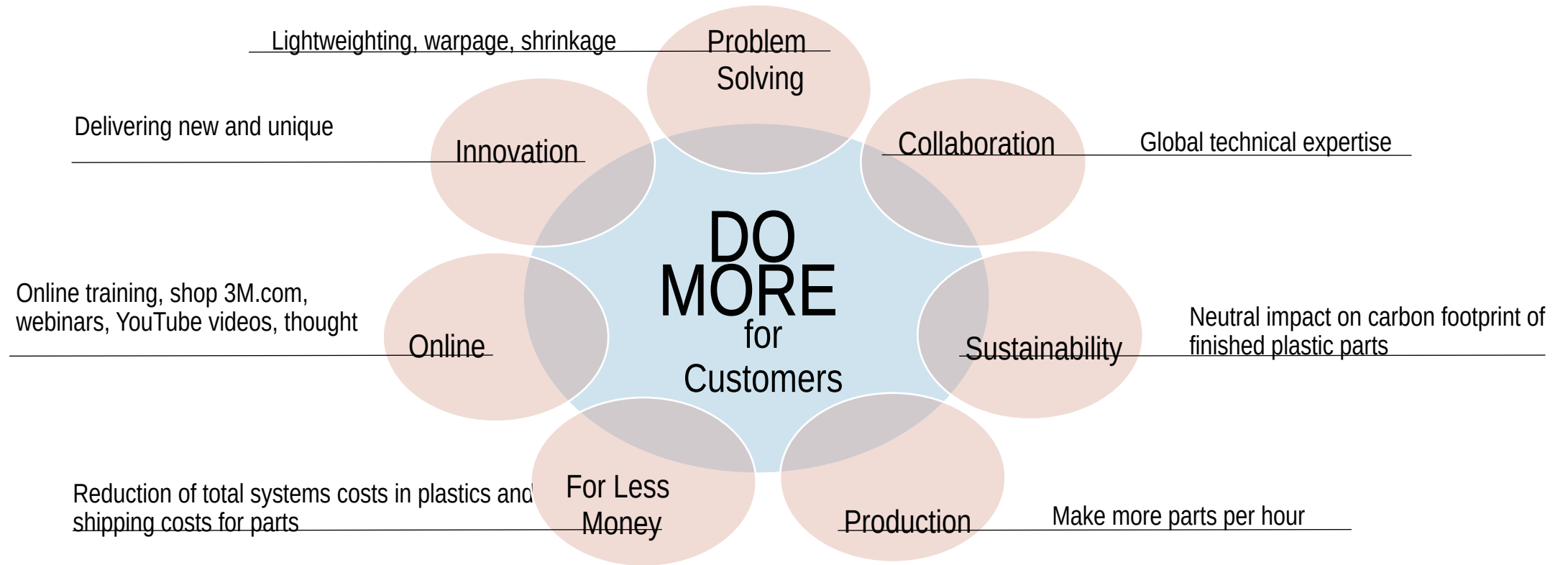


Addition of 3M™ Glass Bubbles has neutral impact on carbon footprint of finished plastic parts

- Single-site carbon footprint study conducted by 3M of one class of glass bubble popular for use in plastics manufacturing
- Additional studies underway
- Common transportation application resins utilized

Plastics manufactured with 3M glass bubbles may be recycled

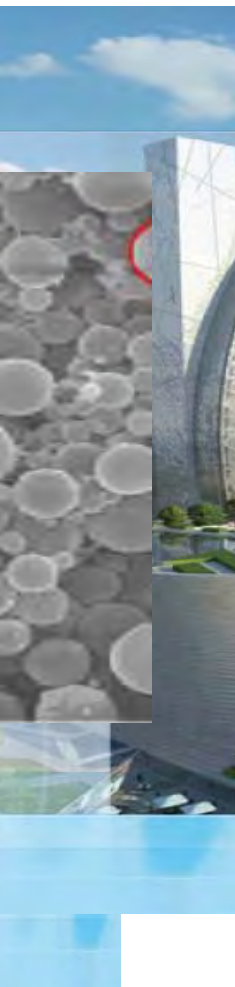
- Minimal change in resin properties up to 5 cycles



Glass Bubble e Risparmio energetico



Come Risparmiare sui consumi energetici e contribuire alla riduzione dell'impatto ambientale ?



3M



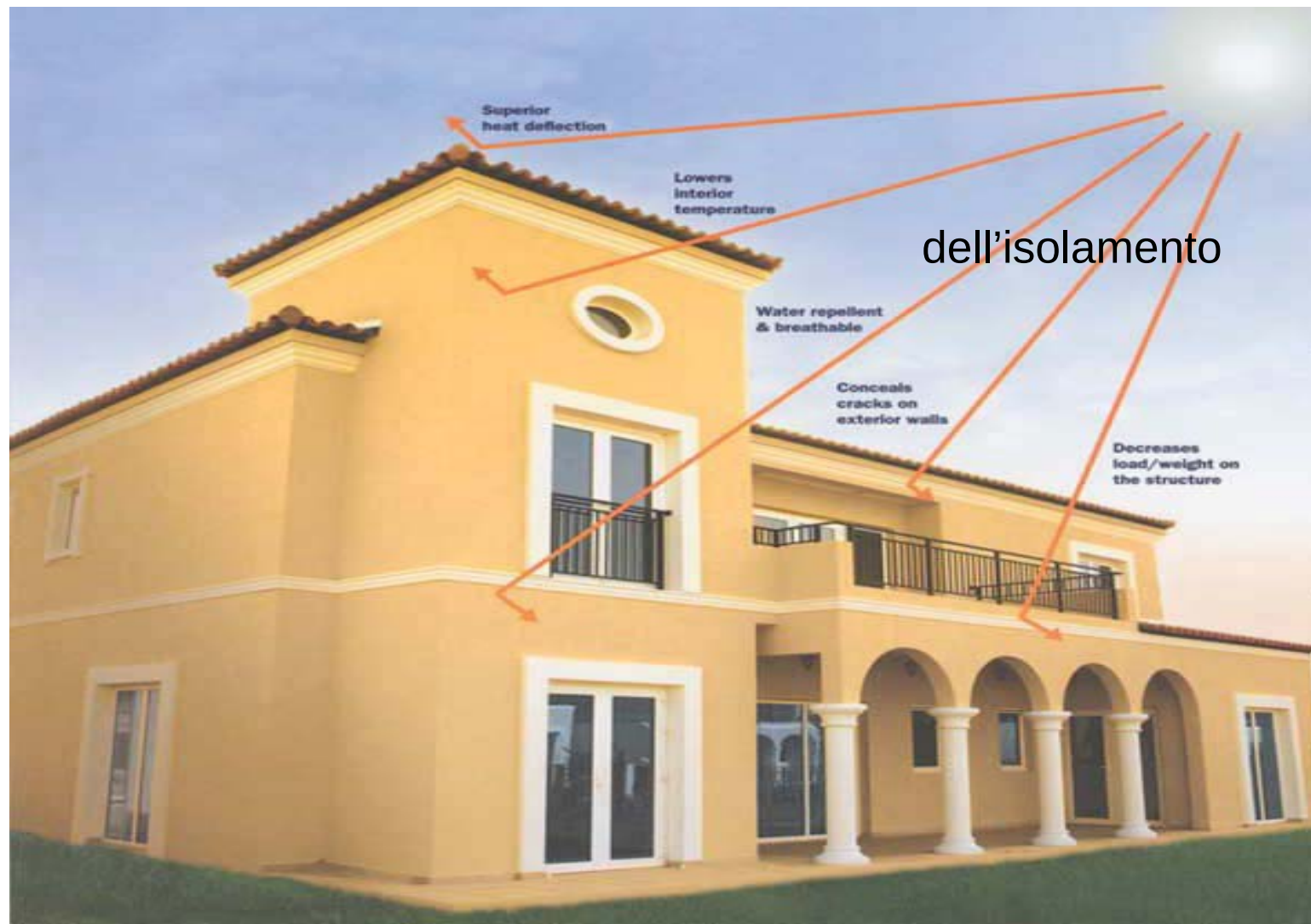
3M™ Glass Bubbles & Risparmio Energetico

Produzione di pitture con:

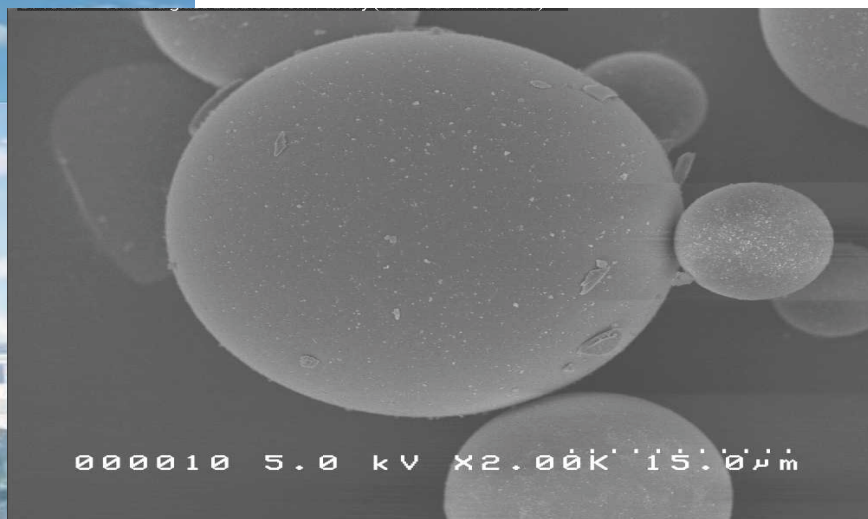
- Riduzione del VOC
- Elevata Riflettanza
- Miglioramento Comfort termico
- Facili da applicare
- Traspirabili

Produzione di materiali :

- Più leggeri
- Resistenti all'umidità
- Con "Warm touch"
- Facili da carteggiare
- Verniciabili



3M™ Microsfere di vetro cave



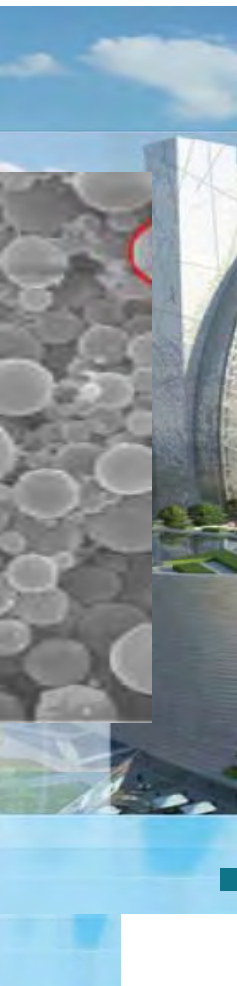
Composizione	Peso %
SiO_2	70 - 80
Na_2O	3 - 8
CaO	8 - 15
B_2O_3	2 - 6

Boro Silicato Di Calcio

- Composizione chimica che pone le microsfere in classe “C” e assimilabili al Pyrex™ Vetro con alte resistenze alla T°
- Vetro insolubile in acqua
- Vetro chimicamente stabile



3M™ Microsfere Ceramiche



Composizione	Peso %
SiO_2	60 - 62
Al_2O_3	21 - 23
Na_2O	9 - 11
K_2O	4 - 6

Alcalin Allumino Silicato Ceramico

3M™ Microsfere Ceramiche sono uniche, Semi-trasparenti, bianche, di dimensione fine , con elevata resistenza

Proprietà Fisiche Glass Bubbles

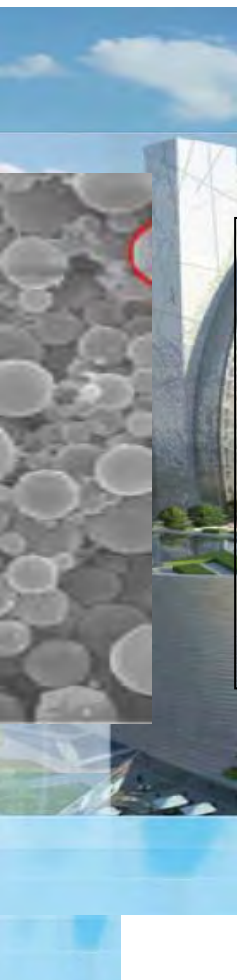
3M™ Glass Bubbles Famiglie Prodotti

Prodotto	Composizione	Target Resistenza Rottura 90% Integre (bar)	Densità Effettiva (g/cm ³)	Dimensione sfere (microns, per volume)				Trattamento Superficiale
				10%	50%	90%	Effective Top Size(95%)	
K1	Soda-lime Borosilicate Glass	17	0,125	30	65	110	120	none
K15		21	0,15	30	60	105	115	none
S22		28	0,22	20	35	60	75	none
K20		34	0,20	30	65	110	120	none
K25		52	0,25	25	55	95	105	none
S32LD		103	0,29	20	40	75	80	none
S32		140	0,32	20	40	75	80	none
S35		210	0,35	15	35	65	75	none
K37		210	0,37	20	40	80	85	none
S38		280	0,38	15	40	75	85	none
S38HS		385	0,38	15	40	75	85	none
K42HS		520	0,42	12	25	45	55	none
K46		420	0,46	15	40	70	80	none
iM16K		1100	0,46	13	22	36	40	none
S60		690	0,60	15	34	55	65	none
S60HS		1240	0,60	11	30	50	60	none
iM30K		1930	0,60	9	17	30	45	none

3M™ Glass Bubbles Serie XLD

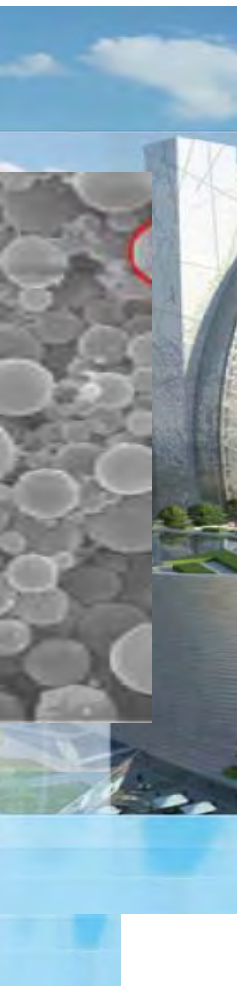
Prodotto	Composizione	Resistenza Rottura Minimo 90% Integre (bar)	Densità Effettiva (g/cm ³)	Dimensione Sfere (microns, per volume)			
				10%	50%	90%	Effective Top Size(95%)
XLD3000	Soda lime borosilicate glass	210	0,23	20	30	45	50
XLD6000		420	0,30	12	17	25	30

Proprietà Fisiche Microsfere Ceramiche



Grade	Composition	Crush Strength (bar)	True Density (g/cm ³)	Particle Size (microns, by volume)				Color
				10%	50%	90%	Top size	
W-210	Silica	> 4000	2.4	1	3	9	12	White
W-410	Alumina	> 4000	2.4	1	4	15	24	White
W-610	Ceramic	> 4000	2.4	1	10	28	40	White

“Solar paint” formulazione STD con CaCO₃



raw material	Density(g/cc)	Weight	W %	Volume	V %	% Vol Dry
Water	1.00	47.21	14.37	47.21	23.61	0.00
Wetting agent	1.16	0.80	0.24	0.69	0.35	0.21
TiO ₂	4.10	61.50	18.71	15.00	7.50	15.00
CaCO ₃	2.70	121.50	36.97	45.00	22.50	45.00
Resin	1.06	94.44	28.74	89.09	44.55	39.04
Glass Bubbles	0.22	0.00	0.00	0.00	0.00	0.00
Thickener	1.06	2.88	0.88	2.71	1.36	0.70
Anti-foam	1.00	0.29	0.09	0.29	0.15	0.05
Totals	1.64	328.62	100.00	200.00	100.00	100.00

Solids by weight %	69.57%	Filler Vol =	60
Solids by volume %	50.00%	Binder Vol=	40
Density wet	1.64	PVC =	60
Density dry	2.29	CPVC =	62.23
		CPVC/PVC =	1.04

“Solar paint” Formulazione con 3M Glass Bubbles K20

raw material	Density(g/cc)	Weight	W %	Volume	V %	% Vol Dry
Water	1.00	47.21	21.84	47.21	23.61	0.00
Wetting agent	1.16	0.80	0.37	0.69	0.35	0.21
TiO2	4.10	61.50	28.46	15.00	7.50	15.00
CaCO3	2.70	0.00	0.00	0.00	0.00	0.00
Resin	1.06	94.44	43.70	89.09	44.55	39.04
Glass Bubbles	0.20	9.00	4.16	45.00	22.50	45.00
Thickener	1.06	2.88	1.33	2.71	1.36	0.70
Anti-foam	1.00	0.29	0.14	0.29	0.15	0.05
Totals	1.08	216.12	100.00	200.00	100.00	100.00



“Solar paint” Formulazione con 3M Glass Bubbles S22

raw material	Density(g/cc)	Weight	W %	Volume	V %	% Vol Dry
Water	1.00	47.21	21.75	47.21	23.61	0.00
Wetting agent	1.16	0.80	0.37	0.69	0.35	0.21
TiO2	4.10	61.50	28.34	15.00	7.50	15.00
CaCO3	2.70	0.00	0.00	0.00	0.00	0.00
Resin	1.06	94.44	43.52	89.09	44.55	39.04
Glass Bubbles	0.22	9.90	4.56	45.00	22.50	45.00
Thickener	1.06	2.88	1.33	2.71	1.36	0.70
Anti-foam	1.00	0.29	0.14	0.29	0.15	0.05
Totals	1.09	217.02	100.00	200.00	100.00	100.00

Solids by weight %	53.92%	Filler Vol =	60
Solids by volume %	50.00%	Binder Vol=	40
Density wet	1.09	PVC =	60
Density dry	1.17	CPVC =	67.52
		CPVC/PVC =	1.13

“Solar paint” Formulazione con 3M Glass Bubbles XLD6000

raw material	Density(g/cc)	Weight	W %	Volume	V %	% Vol Dry
Water	1.00	47.21	21.40	47.21	23.61	0.00
Wetting agent	1.16	0.80	0.36	0.69	0.35	0.21
TiO ₂	4.10	61.50	27.88	15.00	7.50	15.00
CaCO ₃	2.70	0.00	0.00	0.00	0.00	0.00
Resin	1.06	94.44	42.81	89.09	44.55	39.04
Glass Bubbles	0.30	13.50	6.12	45.00	22.50	45.00
Thickener	1.06	2.88	1.30	2.71	1.36	0.70
Anti-foam	1.00	0.29	0.13	0.29	0.15	0.05
Totals	1.10	220.62	100.00	200.00	100.00	100.00

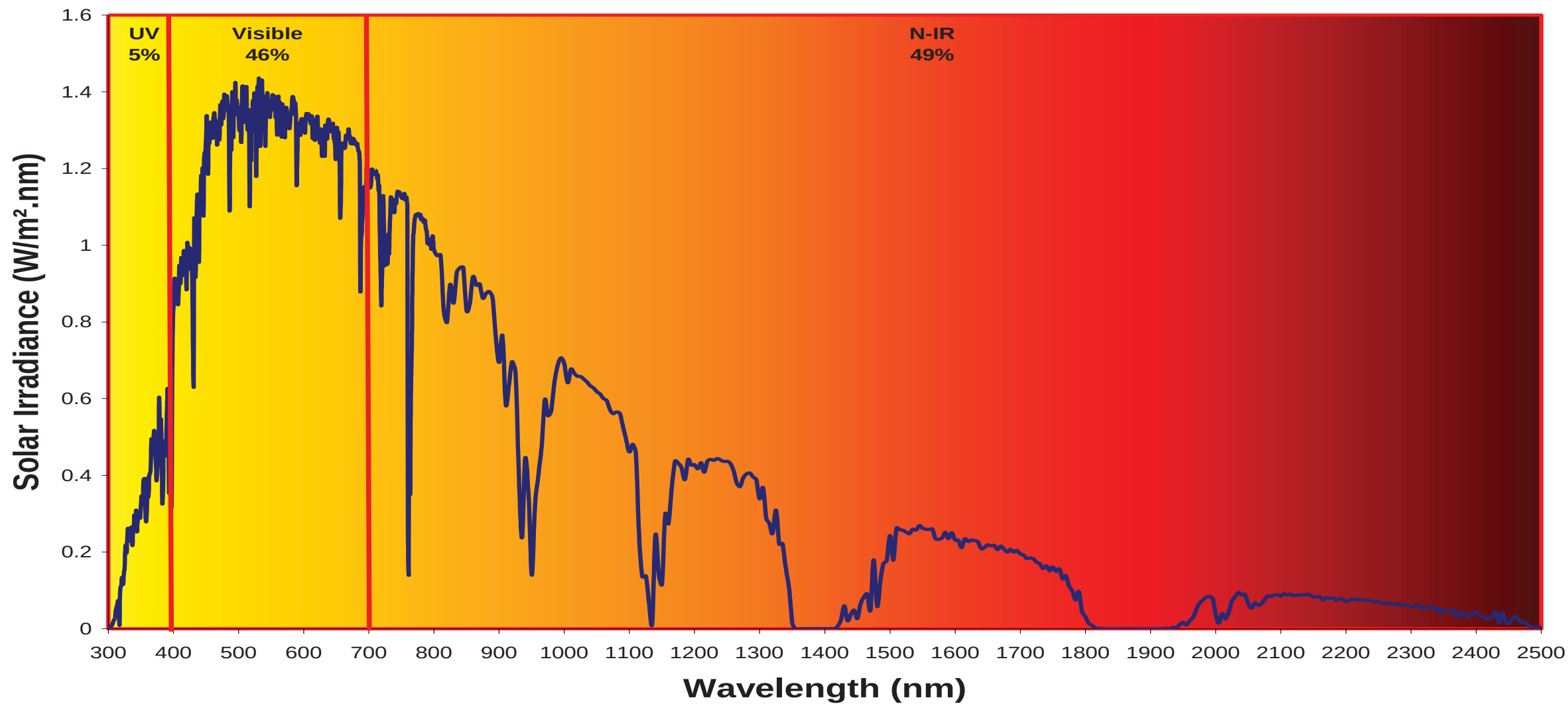
Solids by weight %	54.67%	Filler Vol =	60
Solids by volume %	50.00%	Binder Vol=	40
Density wet	1.10	PVC =	60
Density dry	1.21	CPVC =	67.52
		CPVC/PVC =	1.13

“Solar paint” Formulazione con Microsfere Ceramiche

raw material	Density(g/cc)	Weight	W %	Volume	V %	% Vol Dry
Water	1.00	47.21	19.60	47.21	23.61	0.00
Wetting agent	1.16	0.80	0.33	0.69	0.35	0.21
TiO2	4.10	61.50	25.53	15.00	7.50	15.00
CaCO3	2.70	0.00	0.00	0.00	0.00	0.00
Resin	1.06	94.44	39.21	89.09	44.55	39.04
Ceramic Bubbles	0.75	33.75	14.01	45.00	22.50	45.00
Thickener	1.06	2.88	1.19	2.71	1.36	0.70
Anti-foam	1.00	0.29	0.12	0.29	0.15	0.05
Totals	1.20	240.87	100.00	200.00	100.00	100.00

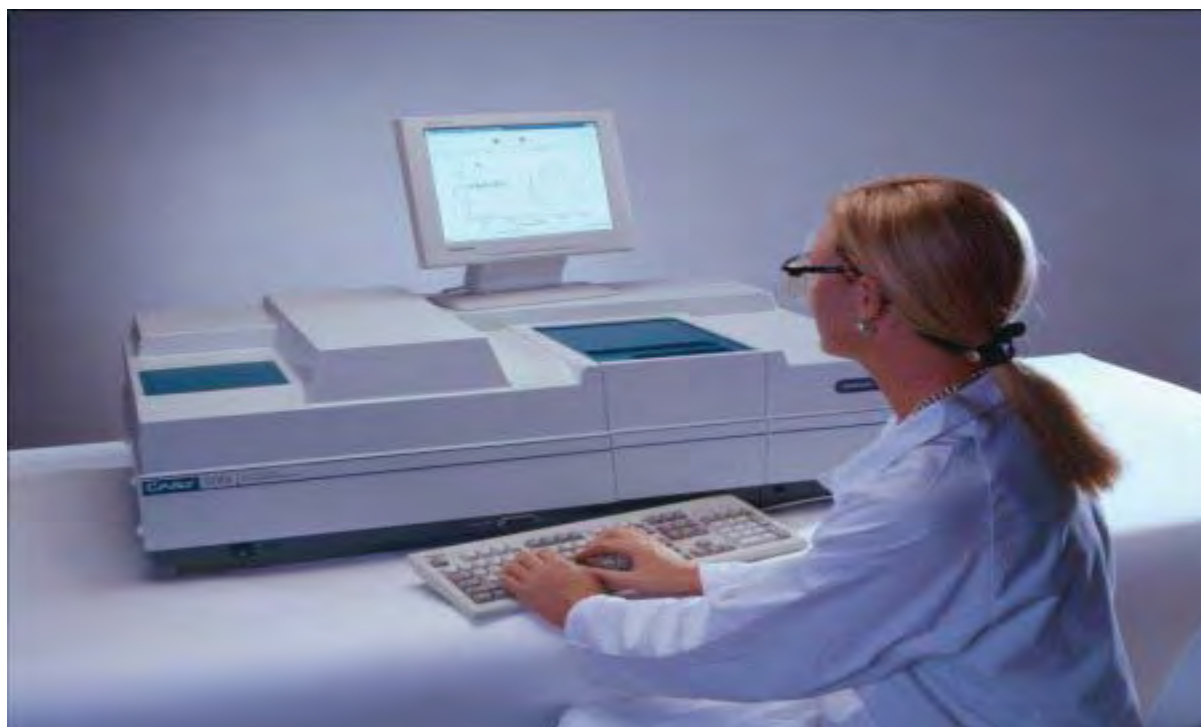
Solids by weight %	58.48%	Filler Vol =	60
Solids by volume %	50.00%	Binder Vol=	40
Density wet	1.20	PVC =	60
Density dry	1.41	CPVC =	67.52
		CPVC/PVC =	1.13

Solar Irradiance



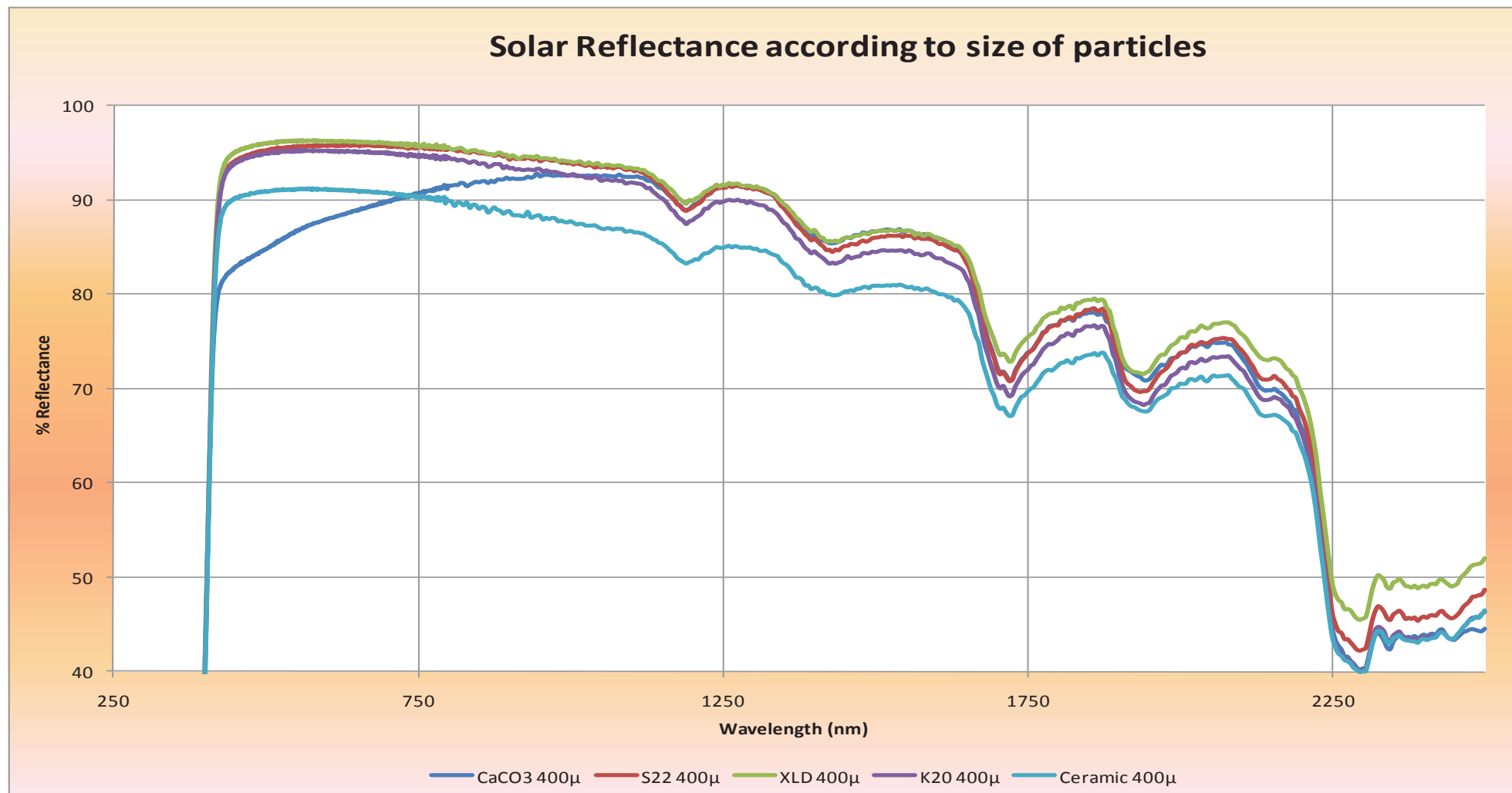
Strumenti di Analisi:

Spettrofotometro Perkin Elmer 950
UV – Visible - N-IR
+ Sfere Integrate



Misurazione delle Proprietà di Riflettanza Emisferici

Dry Paint a spessore



Total Solar Reflectance TSR

La Riflettanza Solare è calcolata secondo il metodo ASTM E903-96 e tabella di riferimento per l'irradiazione dalle ASTM G173-03

Sample	TSR	UV	Visible	IR
CaCO3	83.50	12.56	85.62	88.33
S22	88.20	12.35	93.92	90.08
XLD6000	88.67	12.21	94.50	90.52
K20	87.32	12.33	93.40	88.78
Ceramic	83.35	12.09	89.46	84.43

Quanto
valgono 5
punti di
TSR?

Efficienza termica degli edifici : un “must” nei new Building e nelle ristrutturazioni

- European (council) Cool roof
 - [Cool roof tool kit www.coolroofs-eu.eu](http://www.coolroofs-eu.eu)
- [DOE-2](#) (Department of Energy USA)



*Fonte: Università di Palermo



L'utilizzazione di finiture esterne con particolari proprietà radiative, rappresenta una misura di indubbia rilevanza nel bilancio energetico di un edificio.

In particolare, accentuate caratteristiche riflettenti nel campo della radiazione solare e ridotte proprietà emissive nel campo dell'infrarosso possono determinare, specialmente nella stagione estiva, una riduzione dei guadagni solari diurni e delle dispersioni termiche per re-irraggiamento notturne.

Anche nella stagione invernale, specialmente nei climi in cui il contributo invernale della radiazione solare è limitato e le temperature notturne sono invece basse, si possono ottenere vantaggi complessivi.

L'estrema dipendenza di tali scambi termici dalle condizioni climatiche e della loro variabilità temporale non consente tuttavia una stima affidabile se non utilizzando modelli di simulazione dinamici che siano in grado di effettuare il bilancio energetico su base oraria per un [intero anno climatico](#).



You are here ▶ Project HOME PAGE

CoolRoofs Project



▶ Project HOME PAGE

- » Project Partners
- » EU Cool Roofs Council
- » Database of Cool Roofs Material
- » Market Aspect of Cool Roofs
- » Policy, legislation and cool roofs incentives
- » Demo projects
- » Technical Guidelines Handbook
- » Cool Roofs Toolkit

PROMOTION OF COOL ROOFS IN THE EU

Project Acronym: COOL ROOFS

The specific objectives are: to support policy development by transferring experience and improving understanding of the actual and potential contributions by cool roofs to heating and cooling consumption in the EU; to remove market barriers and simplify the procedures for cool roofs integration in construction and building's stock; to change the behaviour of decision-makers and stakeholders so to improve acceptability of the cool roofs; to disseminate and promote the development of innovative legislation, codes, permits and standards, including application procedures, construction and planning permits concerning cool roofs. The work will be developed in four axes, technical, market, policy and end-users.



Project news

- Farewell: The CoolRoofs Project is now completed...!
- Update on the establishment of the European Cool Roofs Council

Cool Roofs Council creation supported by this PROJECT

- link to the official Cool Roofs Council Portal

Link



- ▶ link to the official Cool Roofs Council Portal
- ▶ Contact the European Cool Roofs Council

About Cool Roofs



- ▶ What are CoolRoofs
- ▶ Glossary
- ▶ Cool roofs in the news
- ▶ Downloads
- ▶ Web Resources
- ▶ Publications

Casa di 100 m² = Sviluppo in m² :162

- MILANO : Saving 1,23 €/m² annuo
- ROMA : Saving 1,48 €/m² annuo
- PALERMO : 1,55 €/m² annuo

- Saving Annuo a :
 - Milano € 214
 - Roma € 258
 - Palermo € 270



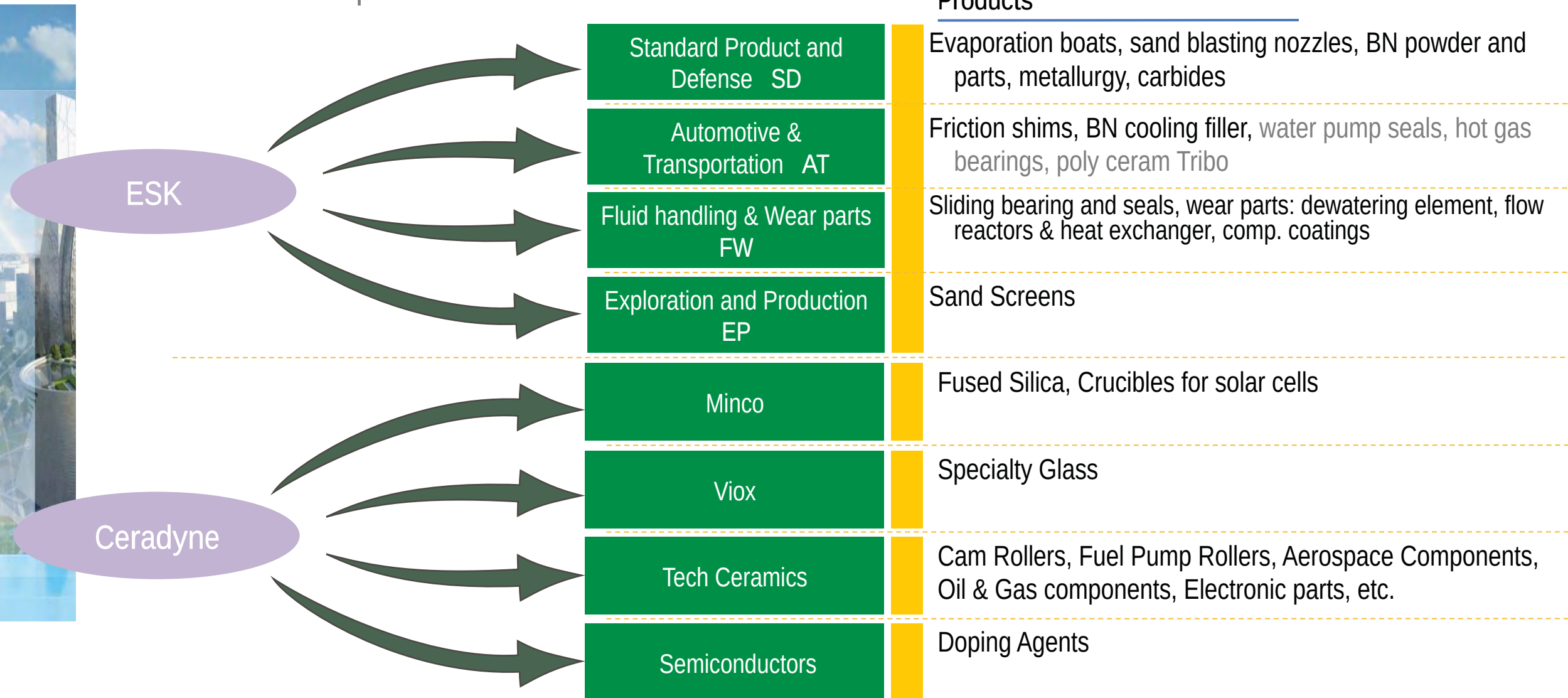
Saving Energetico in Kw/h %

		Saving energetico : Risparmio Kw/h %
Villa unifamiliare	Milano	2%
	Roma	2%
	Palermo	4%
Villetta a schiera	Milano	4%
	Roma	3%
	Palermo	5%
Palazzo	Milano	4%
	Roma	4%
	Palermo	6%



Advanced Ceramic Platform

Sales Teams and products

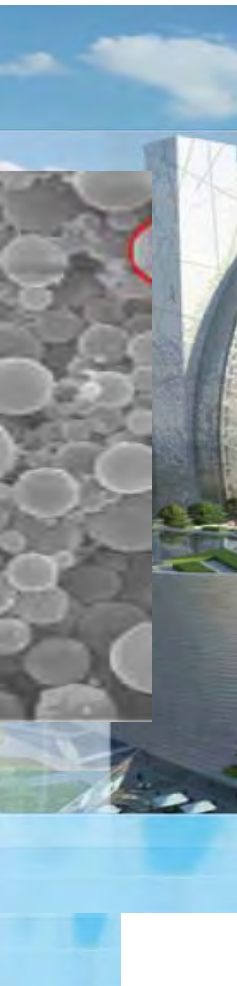


DOMANDE ?



GRAZIE PER L'ATTENZIONE !

THANK YOU FOR YOUR ATTENTION !



Industries Served

Transportation

Automotive & Aerospace

- Weight reduction
- Temperature and wear resistance

Oil & Gas

- Drilling efficiency
- Thermal insulation
- Corrosion, chemical and wear resistance

Rubber & Plastic

- Lightweight additives
- Fluoropolymers and processing aids
- Thermal management and wear resistance

Paints & Coatings

- Improved surface finish
- Reduced resin demand
- Stain resistance

Defense

- Composite armor
- Fuel binders for propellant, ordnance and pyrotechnics

Semiconductor/CPI

- High purity materials and components
- Microwave specialty materials

Industrial

Mining, Manufacturing

- Protection for workers and equipment
- Enhanced explosive power

Energy

Solar, Nuclear, Fuel Cells

- Neutron and radiation control
- Materials for solar cell manufacture

Healthcare

Dental & Cosmetics

- Translucent orthodontics
- Smoother, silky cosmetics
- High purity materials