Transportation & Advanced Polymers

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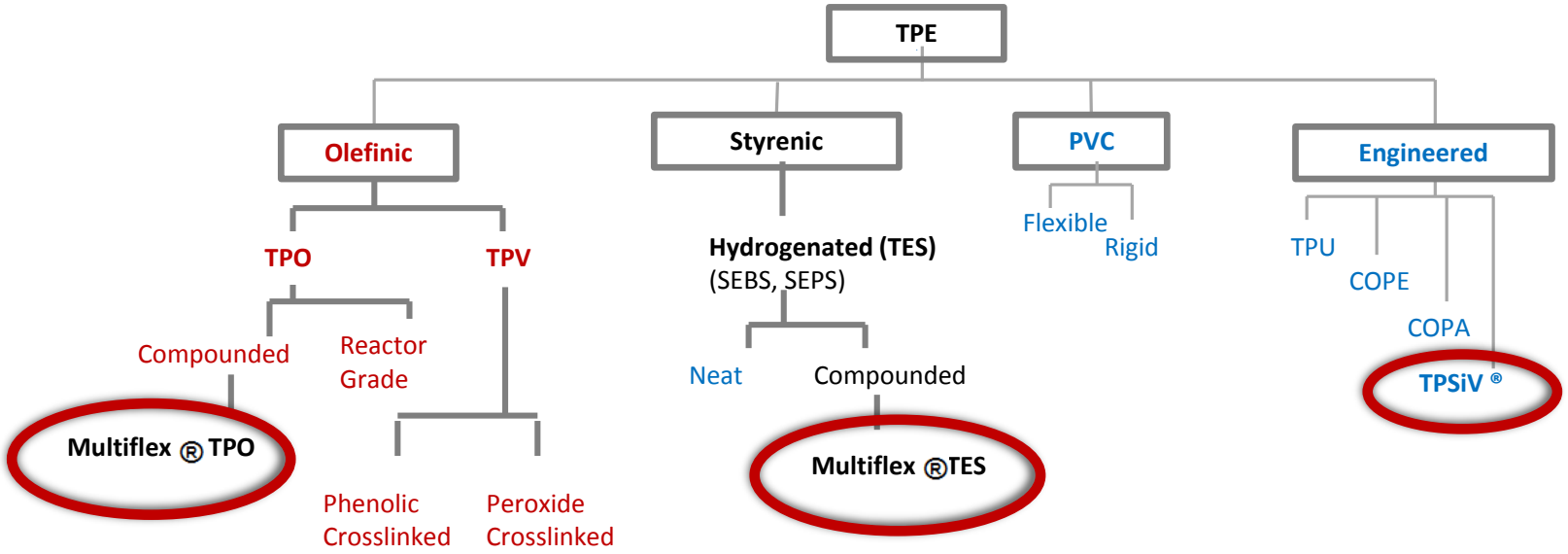
TPSiV® Overview

TPSiV® Technology & Application

Mariusz Makowski / T&AP

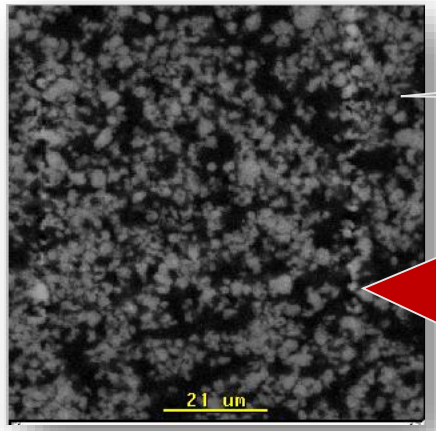
- TPE technologies



What is TPSiV ?

TPSiV®

Patented Technology …



Si-rubber

Plasticizer free

Low CoF

Heat resistance

Chemical resistance

Silky feel

+

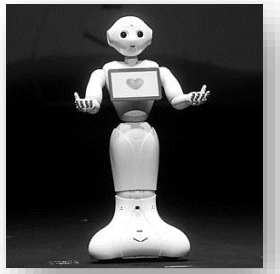
Concept developed on different matrix

Manage bonding property

Chemical resistance

Eco Reaction,
No emission





- ✓ TPSiV® is a Thermoplastic Silicone Vulcanizate that typically has cross-linked Si rubber dispersed in a thermoplastic continuous phase.
- ✓ Typical silicone level from 20 to 40 %
- ✓ TP continuous phase is most commonly TPU but could also be PP or **any other thermoplastic.**
- ✓ Lower durometer without using plasticizers
- ✓ Tailored for application

TPSiV benefits: silky touch feel

Some plastic parts are daily touched or in permanent contact with final users.
Material solution should brings a pleasant touch and feel and must respect permanent skin contact

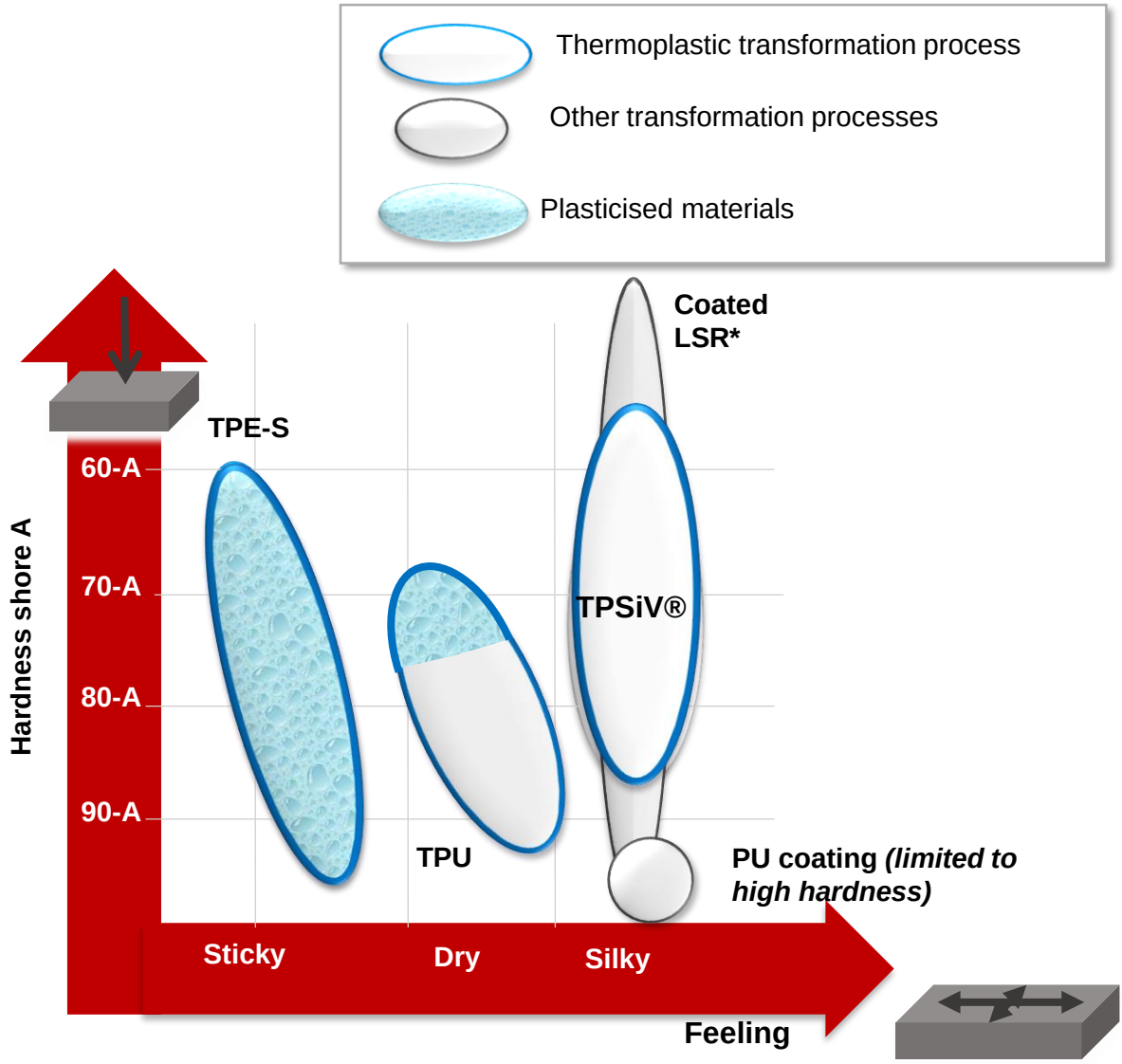
Addition of crosslink Silicone into a plastic brings :

- ✓ Softness: reduce hardness
- ✓ Silky touch: Crosslink silicone phase at surface create a micro-texture, composed of soft and low friction domain.

This combination gives to TPSiV® materials a **unique soft touch and feel**

TPSiV® fulfill **long term skin contact**

Soft touch and feel: Human pannel confirm that TPSiV® materials are best in class silky touch solution
Long term skin contact: *TPSiV® grade fullfill USP chapter <88> and ISO 10993-10:2010 &ISO 10993-12 : 2012*



To achieve a silky feel a soft touch topcoat is applied to LSR surface

TPSiV benefits: Scratch and mar resistance

Parts used in daily life are exposed to mechanical surface agression: TPSiV solution have been tested according standardized method

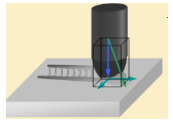
Addition of crosslink Silicon elastomer to plastics

- ✓ Reinforce the surface frictional resistance.
- ✓ Brings resistance to indentation and maring

Scratch and mar resistance: *assessment of the damage caused by a surface stress.*

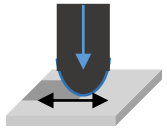
- *Visual ranking of the aspect change: subjective!*
- *Colorimetric (ΔE*, ΔL*, Δa*, Δb*) and Gloss (ΔGloss) change measurement.*

Scratch: steel pin

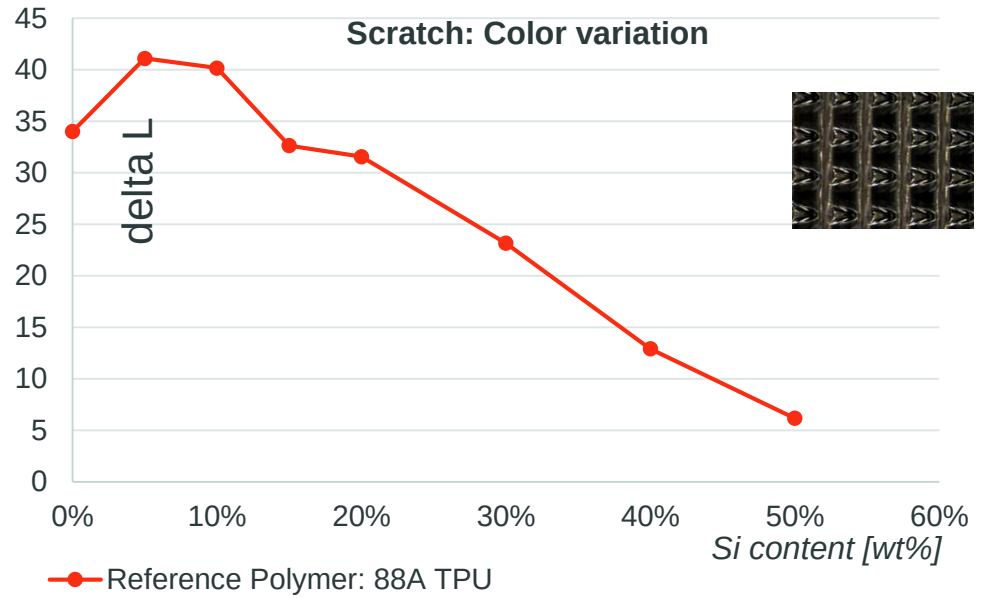


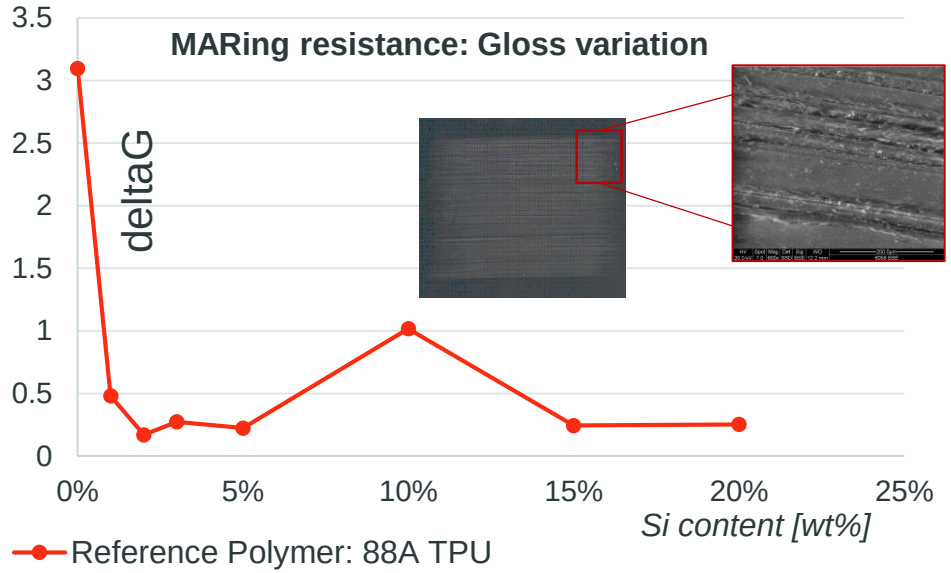
Scratch pattern

Mar: coton fabrics



Mar pattern





TPSiV benefits: stain resistance

Parts used in daily life are exposed to chemical surface agression: TPSiV solution have been tested according standardized method against static and dynamic stain

Addition of Cross link Silicon elastomer brings surface resistance to most of daily chemical

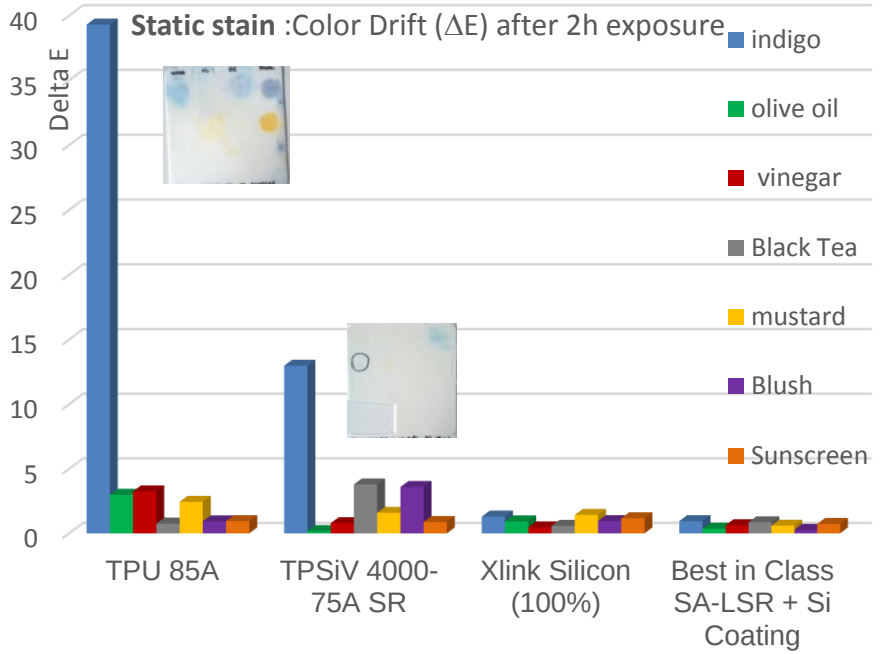
- ✓ Cross link Silicon is intrinsically stain resistant
- ✓ Silicon phase modify the hydrophilic /hydrophobic balance, reducing chemical interaction ability of surface and transfer of die to plastic surface
- ✓ Reinforce the surface frictional resistance.

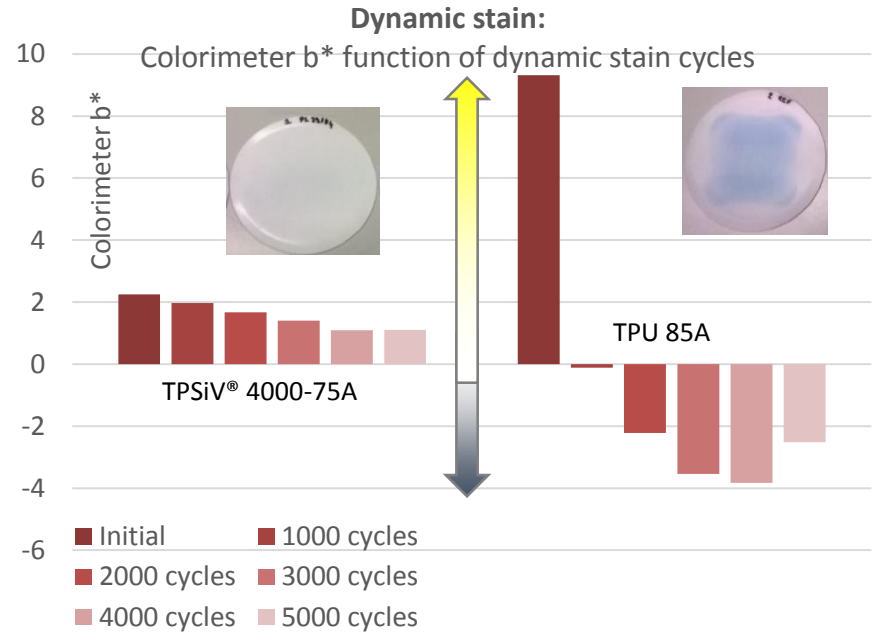
Static and Dynamic resistance: *assessment of the color change caused by a chemical stress*

- *Colorimetric (ΔE*, ΔL*, Δa*, Δb*) measurement.*

Staic stain test *: drops of daily chemical are applied on surface for 2h, excess cleaned and surface color change measured.*

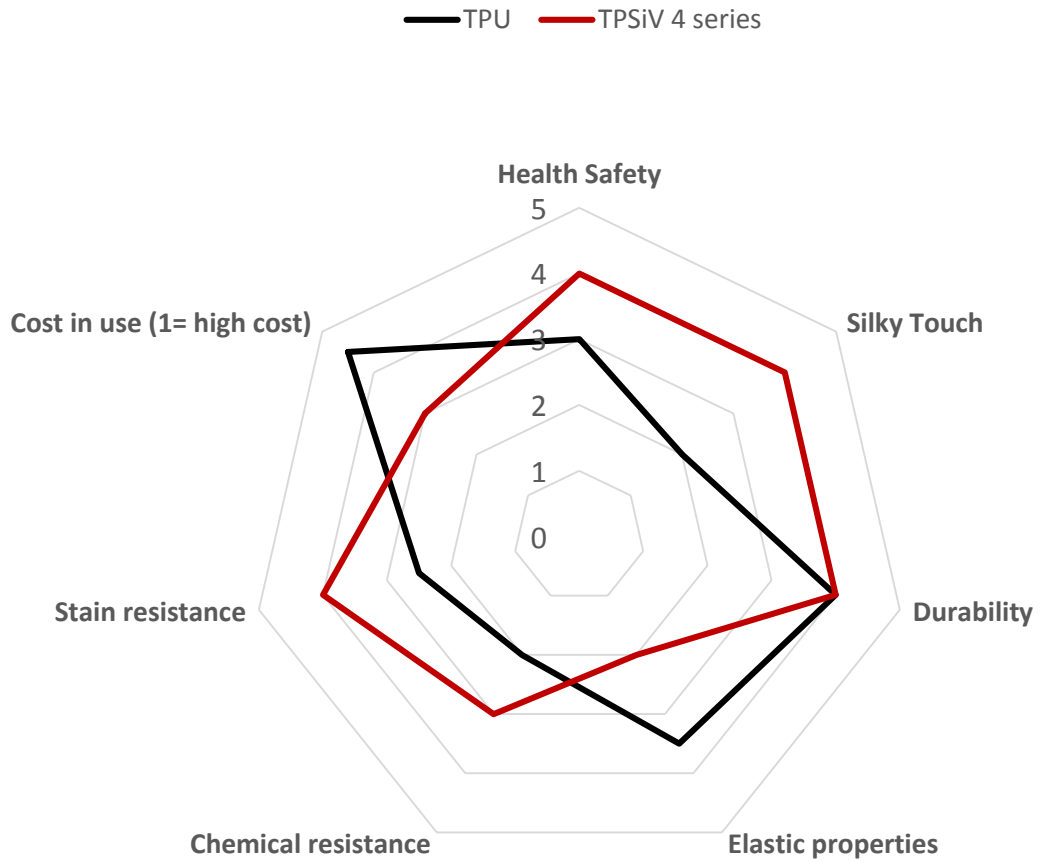
Dynamic stain test: *surface is exposed to Blue Jean fabric mar using Martindale for 5000 cycle, then surface color change measured*





TPSiV® Products range: 4 series

- Primary dedicated to Personal Electronic Application
- Continous thermoplastic matrix : based on TPU
  - thermoplastic processability
  - bonding to PC, ABS, ASA, SAN, (Nylon possibly) / overmolding
  - Coloration
  - UV stability
- Dispersed phase: Cross-link silicone (elastomer) :
  - softness, w/o plasticizer
  - soft touch,
  - chemical resitance (static and dynamic),
  - further surface resistance (Scratch, Mar, abrasion),
  - reduce coefficient of friction.

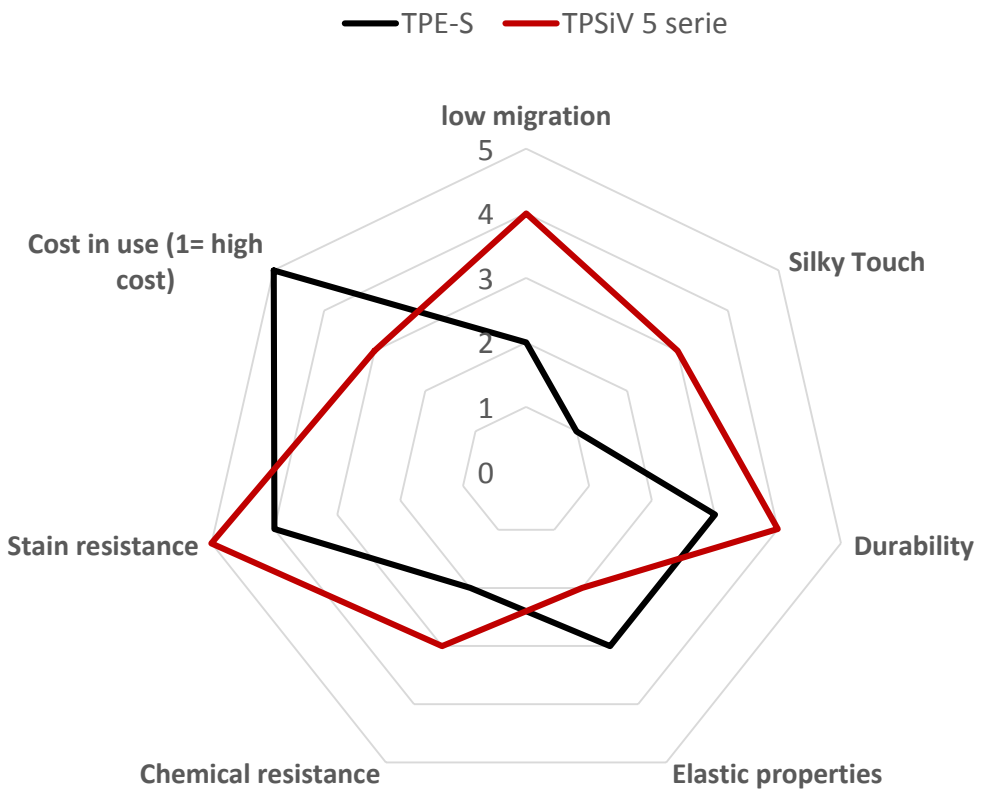


TPSiV® 4000-50A
TPSiV® 4000-60A
TPSiV® 3345-65A
TPSiV® 4000-75A SR

TPSiV® 4200-70A
TPSiV® 4200-75A SR

TPSiV® Products range: 5 series

- Primary dedicated to Consumer application
- Continous thermoplastic matrix : based on polyolefin
  - thermoplastic processability
  - bonding to PP – PE and polyolefin elastomer/ overmolding
  - Coloration
  - UV stability
- Dispersed phase: Cross-link silicone (elastomer) :
  - softness, w/o plasticizer
  - soft touch,
  - further surface resistance (Scratch, Mar, abrasion),
  - reduce coefficient of friction.



TPSiV® 5300 A6002
TPSiV® X5300 A8503
For potable water pipes

TPSiV® Products range:

TPSiV® 4000 series
For aesthetics&outdoor

Excellent UV stability

Overmolding on PC, ABS, ASA, SAN, (Nylon possibly)

TPSiV® 4000-50A
TPSiV® 4000-60A
TPSiV® 3345-65A
TPSiV® 4000-75A SR

TPSiV® 4200 series
For General purpose

Superior chemical resistance, and durability

Overmolding on PC, ABS, ASA, SAN, (Nylon possibly)

TPSiV® 4200-70A
TPSiV® 4200-75A SR

TPSiV® 5300 series
Flexibility and hygiene

Stain and Fluid resistance

Overmolding on Olefine resins

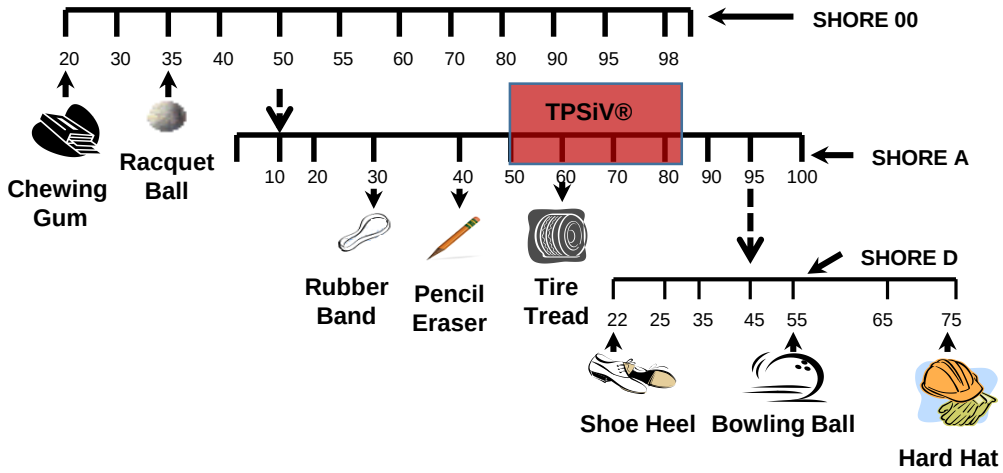
TPSiV® 5300 A6002
TPSiV® X5300 A8503
for water pipes

TPSiV benefits and uses

TPSiV® Combines the processing of thermoplastic resins with the performances of silicone rubber

This technology helps to achieve

- ✓ Lower durometer without using plasticizers
- ✓ Abrasion resistance reinforcement
- ✓ Lower coefficient of friction and modified haptics.
- ✓ Weathering stability: heat & UV resistant
- ✓ Chemical resistance: Inert in fluids



TPSiV® hardness range covers from 50A up to 85A shore A

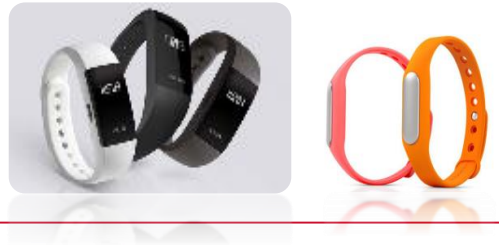
TPSiV® are curently used when a complex combination of performance is needed, such as high end tactile application or heat/mechanical exposed parts.

Mobile Cases:

- *stain and scratch,*
- *grip and soft feel,*
- *Shock and UV resistance*

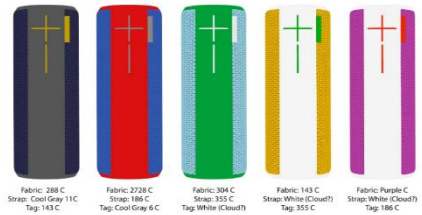
Watches:

- *Long term skin contact*
- *Comfort*
- *Stain and mar*



Speaker:

- *Stain, scratch and mar*
- *Shock resistance*
- *Water and dust proof*
- *UV resistance*



Potable water pipe:

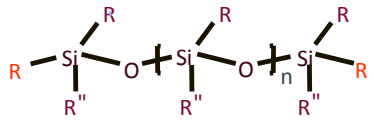
- *Flexibility*
- *Potable Water contact approved (hot and cold), most of local reg.*

What are silicone masterbatches (SiMB) ?

SiMB = Masterbatch, composed of:

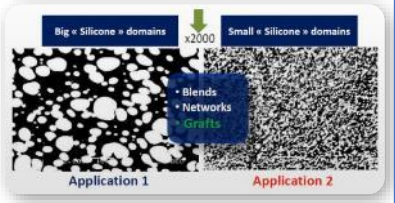
Mw = 250	1 cSt
Mw = 1,000	10 cSt
Mw = 5,000	100 cSt
Mw = 25,000	1,000 cSt
Mw = 55,000	10,000 cSt
Mw = 100,000	100,000cSt
Mw = 300,000	10,000,000cSt

50%,
40%
25%



UHMW PDMS (Fluids/Gums)

+



Compounded or reactively extruded with a Thermoplastic carrier

PP, PE, HIPS, POM, ABS, PA,..

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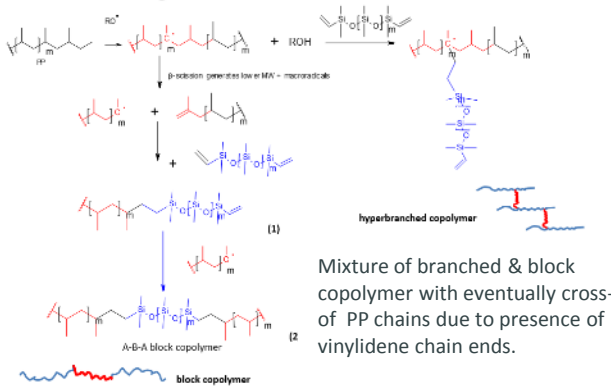
Free Flowing Pellet Masterbatches

Chemistry : What is happening in the extruder ? Hypothesis



Mixture of branched & block copolymer with eventually cross-linking of PP chains due to presence of vinylidene chain ends.