



The 1st International Conference on

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Masterbatch and Compound

15,16February 2016 - Iran Polymer and Petrochemical Institute





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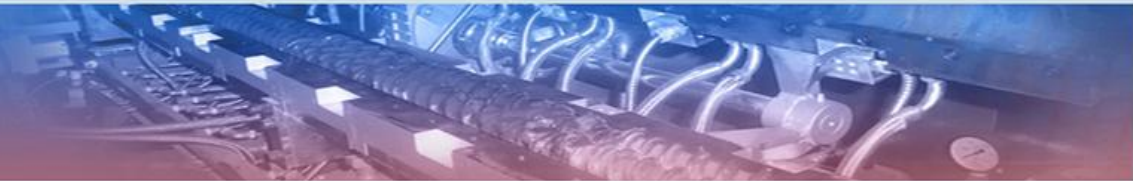
15,16 February 2016 - Iran Polymer and Petrochemical Institute

Cross-linked Polyethylene (PEX), The New Generation of Steel Pipe coating

(Mostafa Safari, Ahmadreza Shafieizadegan Esfahani)

Presenter: (Mostafa Safari)

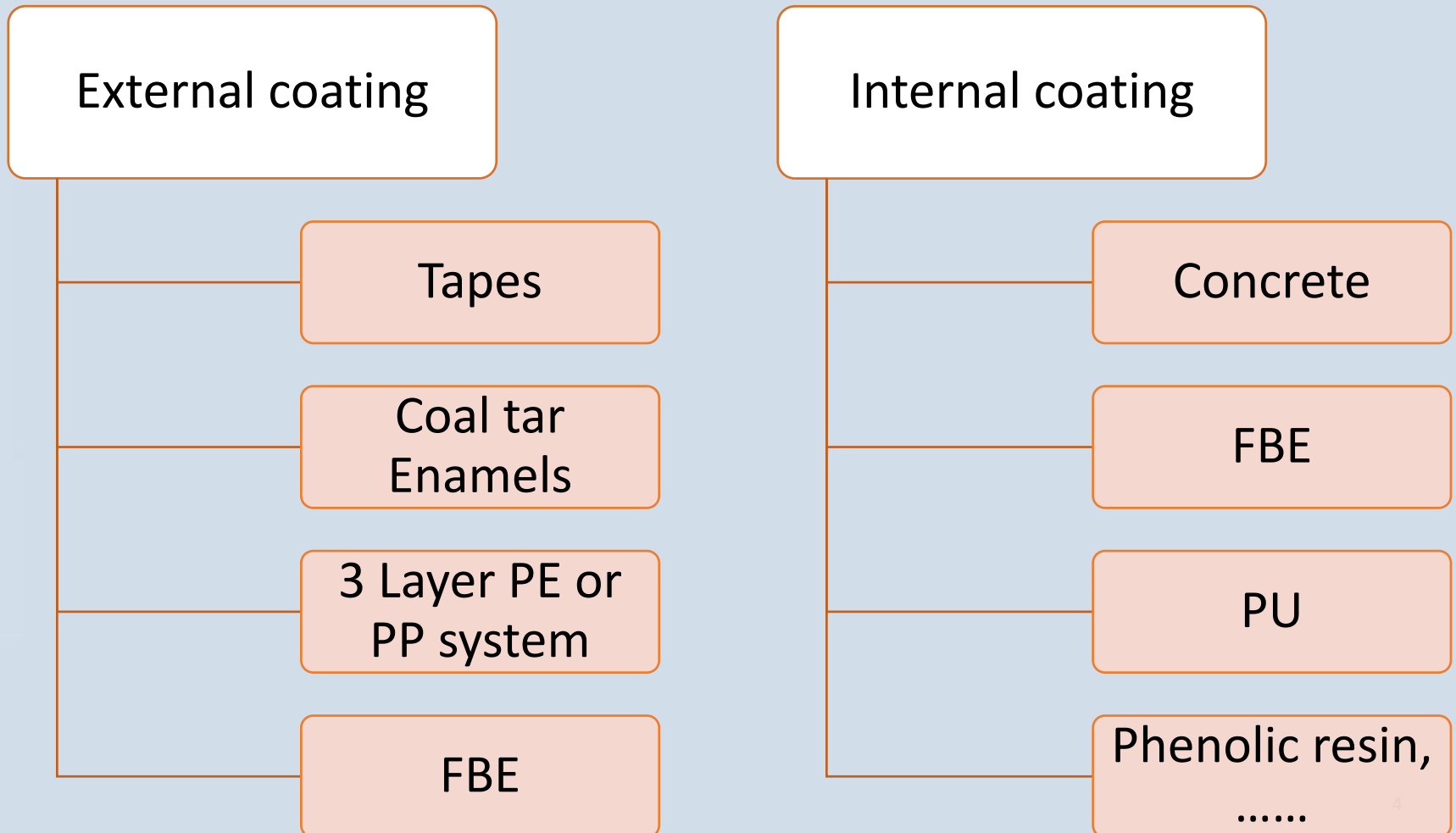




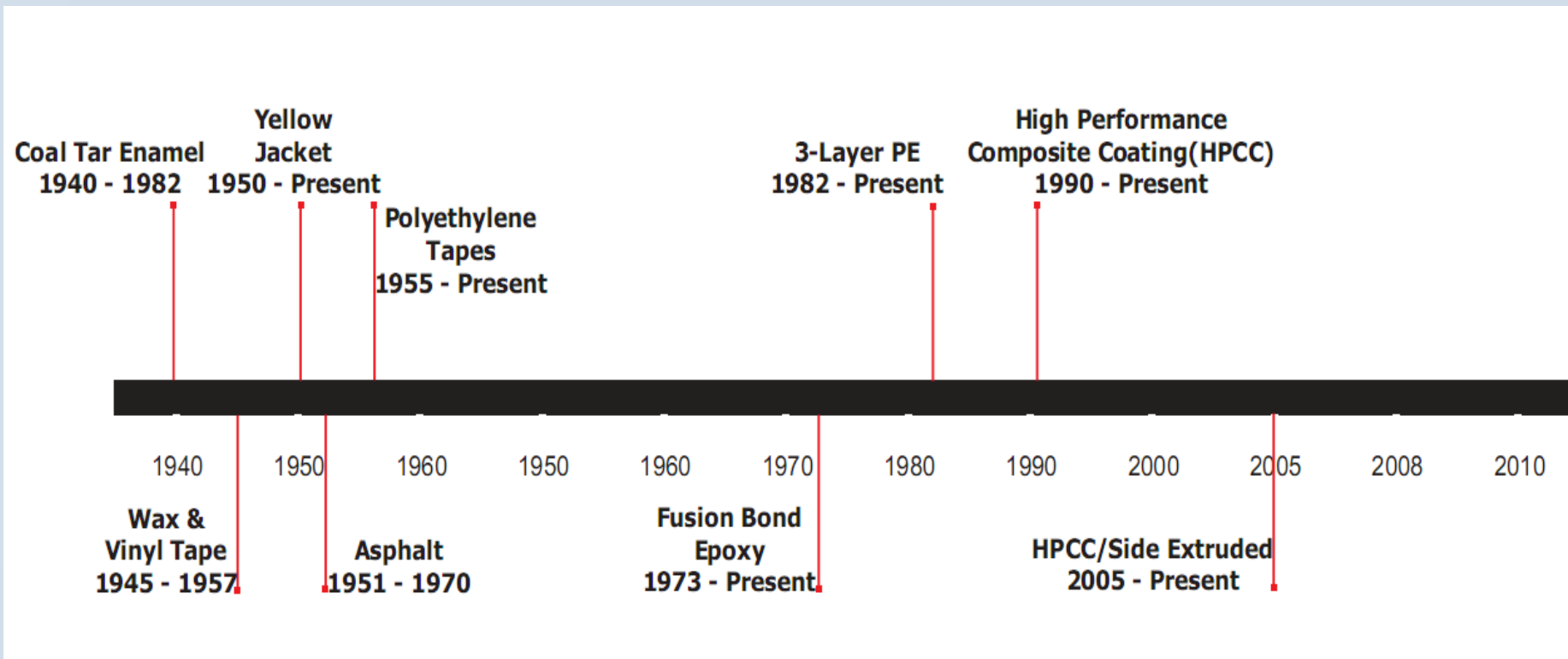
corrosion protection Du to Pipeline coating



- Pipeline coating


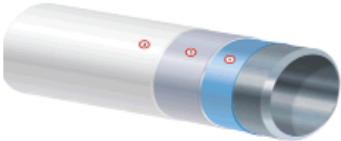
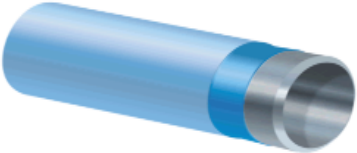
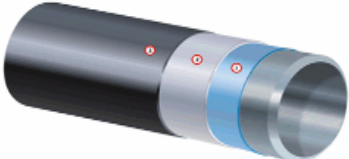


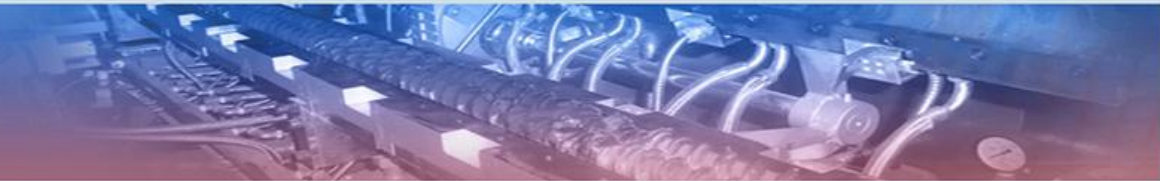
- History of pipe coating



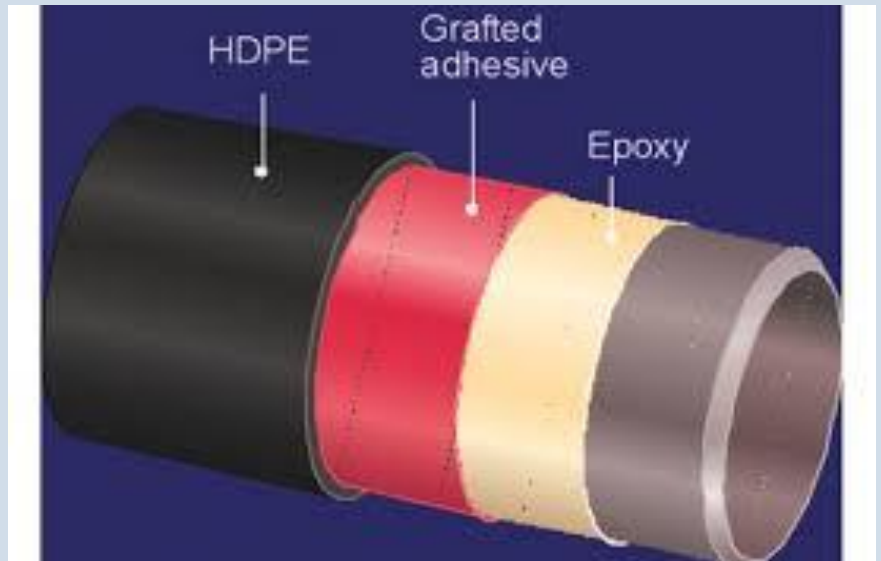


- Pipeline coating

FACTORY APPLIED COATING	PICTORIAL VIEW	MAXIMUM TEMPERATURE RATING
Coal Tar Enamel		60°C
3 Layer Polypropylene		140°C
Dual Layer Fusion Bonded Epoxy		110°C
3 Layer Polyethylene		80°C



- 3ply Polyolefin coating system



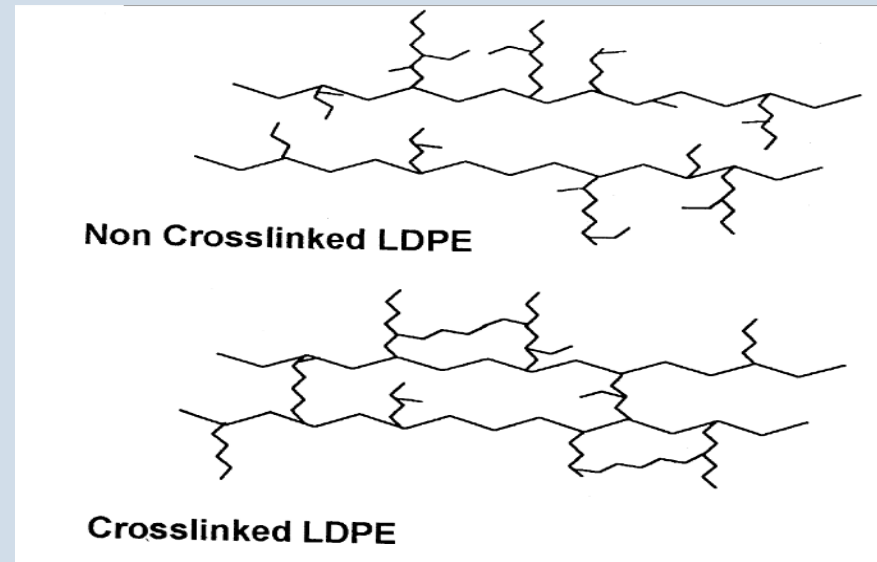
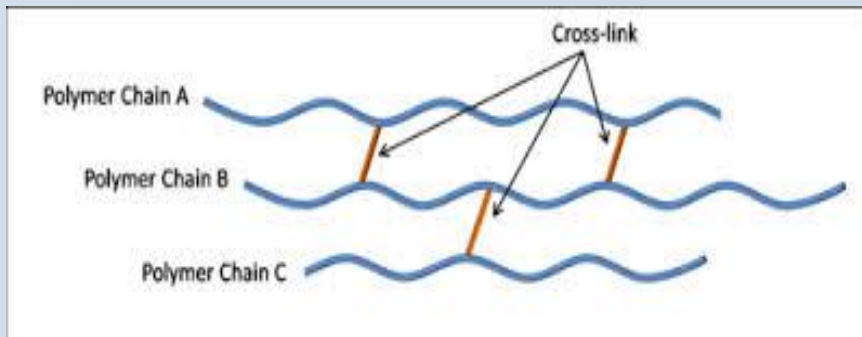


- Pipe coating method

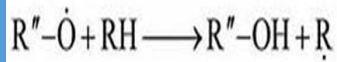
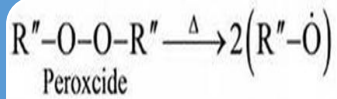


- Top coat materials:
 - PE 3840(Tabriz Petrochemical company)
 - Borcoat HE 3450(Borealis)
 - PEX (Kimia Javid)

- What is crosslinking:
- A cross-link is a bond that links one polymer chain to another. They can be covalent bonds or ionic bonds

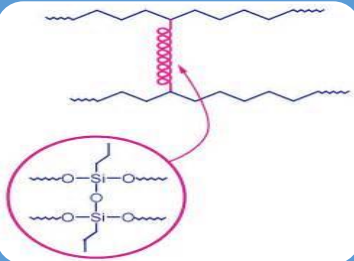


• Crosslinking Method



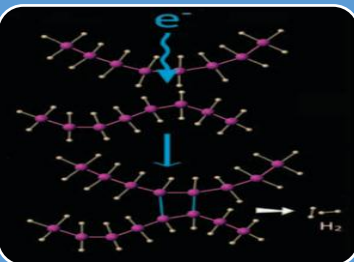
PEX-a

- Crosslinking by Peroxide
- Gel content more than 70%
- Applicable for Pipe, Wire and Cable



PEX-b

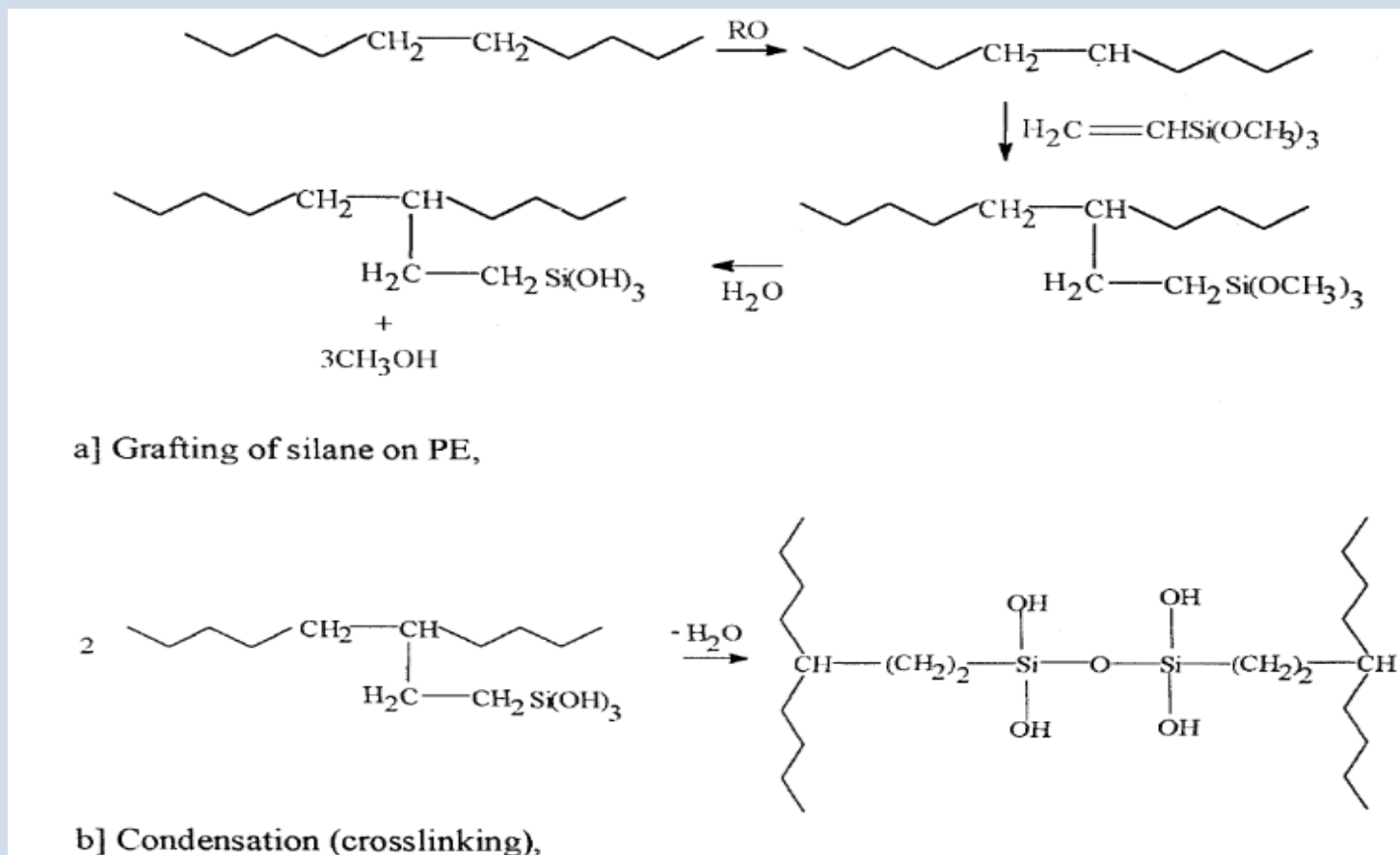
- Crosslinking by Silane
- Gel content more than 65%
- Applicable for Pipe, Wire and Cable



PEX-c

- Crosslinking by Electron beam
- Gel content more than 60%
- Applicable for Packaging film

- PEX-b





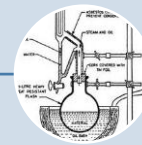
- Curing condition

زمان پخت (hr)		Coating thickness	Curing method	Time to reach 65% gel Content (hr)
Humidity (%)	Temperature (°C)			
50	25	0.7	Ambient curing	96
75	25	0.7	Ambient curing	72
100	90	0.7	Steam curing	6
100	90	2.1	Steam curing	9



- Top coat materials:
 - PE 3840(Tabriz Petrochemical company)
 - Borcoat HE 3450(Borealis)
 - PEX (Kimia Javid)

- Evaluation of materials



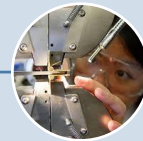
Gel content

$$\rho = \frac{m}{V}$$

density

volume

Density



Mechanical Properties



ESCR



Hot set



Hard ness



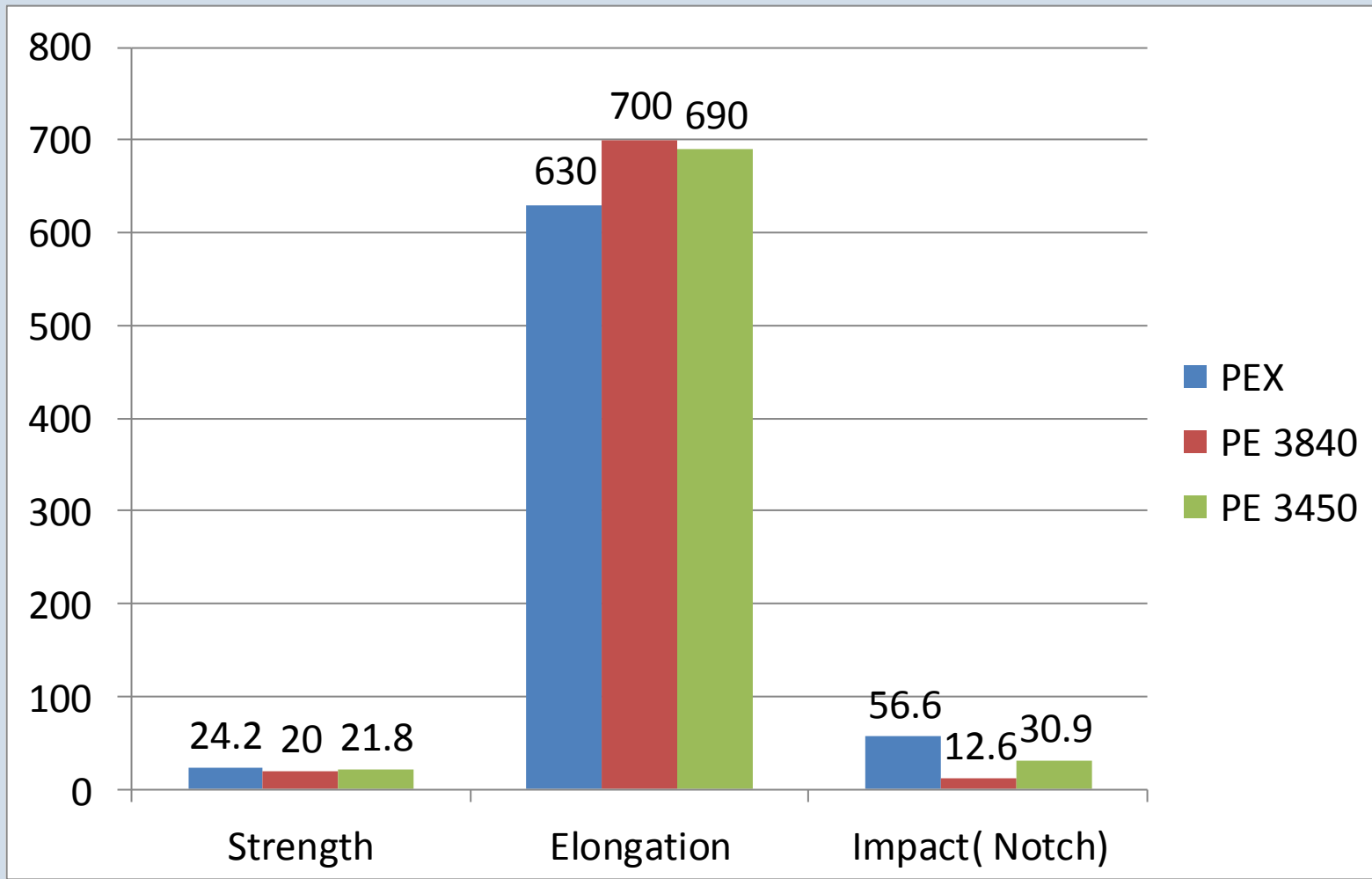
- Gel content

Materials	Test method	Unit	Value
PEX	ASTM D2765	%	70
PE 3840	ASTM D2765	%	0
PE 3450	ASTM D2765	%	0

- Density

Materials	Test method	Unit	Value
PEX	ISO 1183	gr/cm ³	0.942
PE 3840	ISO 1183	gr/cm ³	0.939
PE 3450	ISO 1183	gr/cm ³	0.955

- Mechanical Properties



- ESCR

Materials	Test method	Unit	Value(F10)
PEX	ASTM D1693	hr	>2000
PE 3840	ASTM D1693	hr	8
PE 3450	ASTM D1693	hr	>2000

- Hot Set

Materials	Test method	Unit	Value	
			H.C.E	H.S.E
PEX	IEC 60811-2-1	%	H.C.E	86
			H.S.E	6
PE 3840	IEC 60811-2-1	%	Fail in 1 Min	
PE 3450	IEC 60811-2-1	%	Fail in 1 Min	



- Hardness

Materials	Test method	Unit	Value
PEX	ISO 868	-	64
PE 3840	ISO 868	-	62
PE 3450	ISO 868	-	62

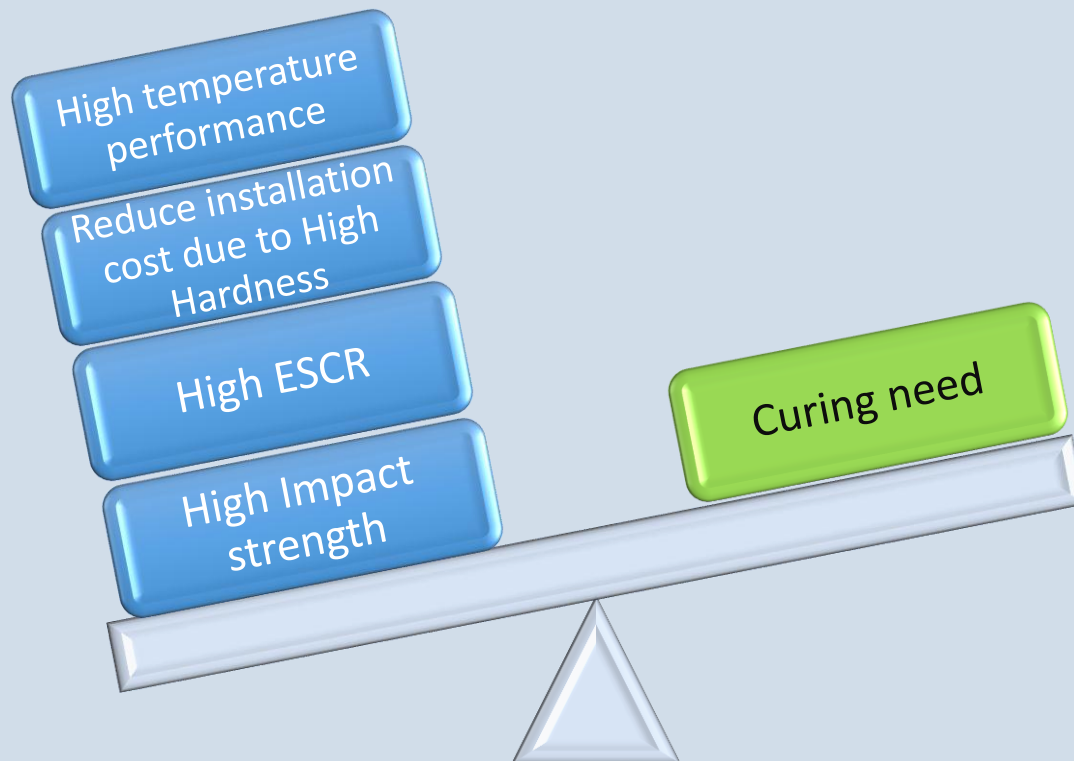
- Vicat

Materials	Test method	Unit	Value
PEX	ISO 306/A50	°C	118
PE 3840	ISO 306/A50	°C	117
PE 3450	ISO 306/A50	°C	118

Conclusion

Advantage

Disadvantage



- 1-G.P. Guidetti, G.L. Rigosi, R. Marzola, The use of polypropylene in pipeline coatings, Montell Polyolefin, Montell Italia S.p.A., G. Natta Research Center, P. le Donegani 12, 44100 Ferrara, Italy
- 2-G.R.Howell,Y.F.Cheng, Characterization of high performance composite coating for the northern pipeline application, Department of Mechanical and Manufacturing Engineering,University of Calgary, Calgary, Alberta, T2N1N4 Canada, July2007
- 3-Russian Oil and Gas Industry News from the Commonwealth of Independent States | GDS Publishing. High performance materials for the Russian pipe coating industry, By Lyondell Basell Industries
- 4- Dr. Shanhong Song, Jacob Chacko, Dr. Ali Ghalambor, Pipeline External Corrosion Protection, University of Louisiana at Lafayette
- 5- Sahar Al-Malaika, Reactive Modifiers for Polymers, Springer, Jun 30, 1997
- 6- S M Tamboli, S T Mhaske & D D Kale, Crosslinked polyethylene, Institute of Chemical Technology, University of Mumbai, Matunga, Mumbai 400 019, India, Indian Journal of Chemical Technology, Vol. 11, November 2004, pp. 853-864
- 7- Eric R. Pohl, Process For Crosslinking Thermoplastic Polymers With Silanes Employing Peroxide Blends, The Resulting Crosslinked Thermoplastic Polymer Composition And Articles Made Therefrom MOMENTIVE PERFORMANCE MATERIALS INC, August 12, 2010
- 8- PEX General Presentation, PEX Association, 2011
- 9- S M Tamboli, S T Mhaske & D D Kale, Institute of Chemical Technology, University of Mumbai, Indian Journal of Chemical Technology,Vol. 11, November 2004, pp. 853-864

Thank you for
the patient
hearing

