THE NEXLENETM ADVANCED TECHNOLOGY PLATFORM

SABIC SK NEXLENE COMPANY

International Polyolefins Conferences 2017

Contents

- 1) Market opportunity for mPE, including POP and POE
- 2) Introduction to SABIC SK Nexlene Company
- 3) Introduction to Nexlene technology and products
- 4) Nexlene Future

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Global mPE Market

Polyolefin market analysis*



Note: Chart represents relative position of products. Bubble size represents relative market size of each product in 2016.

Market attractiveness factors

- Demand
- Demand growth
- Number of suppliers
- Price

Opportunity index factors

- Performance benefits
- Intra-material competition
- Opportunity in specialty markets

РЕ Туре	Density (g/cc)*	Melt Index (MI, g/10 min)
mLLDPE	0.912 - 0.920	0.5 - 30.0
mPOE	0.857 - 0.885	0.5 - 30.0
mPOP	0.886 - 0.910	0.5 - 30.0
mMDPE	0.923 - 0.945	0.5 - 30.0

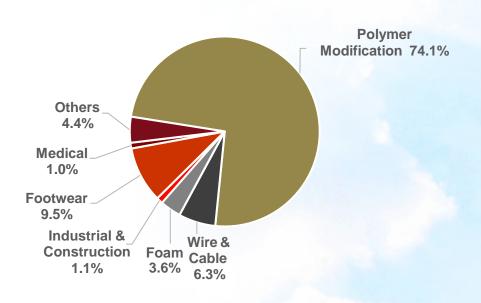
*SSNC definition

POE (Polyolefin Elastomer)

Characteristics of POE

- ✓ Easy processing with high flow
- ✓ Products are lighter than other TPE products
- ✓ Compatible to PP for TPO products

POE market by application



Demand for POE in 2016 = 623 KT

SSNC expects 6-8% annual POE market growth over the next 5 years

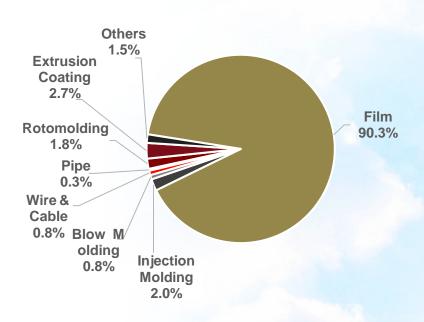
POP (Polyolefin Plastomer)

Characteristics of POP

- ✓ Excellent sealability

 (Low seal initiation temperature, high hot tack)
- **✓** Enhanced toughness
- ✓ Clarity
- √ Hygienic property

POP market by application

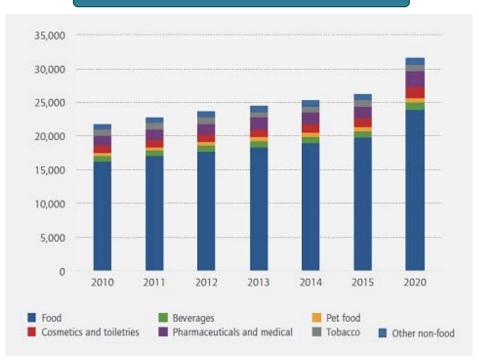


Demand for POP in 2016 = 596 KT

Global POP market in Packaging

Global **flexible packaging market** is forecast to grow at 3-4%, closely matching economic growth over the next few years – While mPOP will grow at a much faster rate

Flexible packaging market (MMTA)



- Polyolefin Plastomers: 886-910 density
- Extrusion coating and in multilayer packaging film applications
- Differentiated based on SIT, seal strength, cling, and clarity.
- Global POP market is estimated to grow from about \$4B USD currently to almost \$6B USD in little over five years.
- SSNC expects 6-8% annual POP growth

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- Founded in 1976 and 40 years of growth
- 3rd largest global chemical company
- 247th largest company in Fortune Global 500 in 2016
- HQ: Riyadh, KSA
- 87.5 billion USD total assets, 39.5 billion USD annual revenue in 2015
- 40,000 employees in 50 countries
- 3rd largest polyethylene supplier in the world





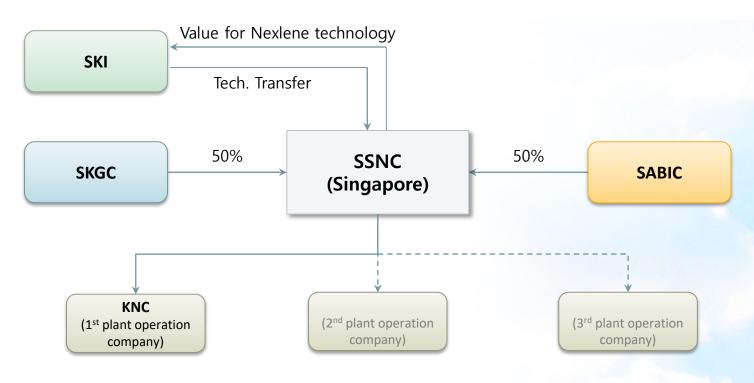


- Founded in 1962 and 54 years of growth
- Affiliate of SK Holdings, 294th largest business group in Fortune Global 500 in 2016
- HQ: Seoul, Korea
- 1st naphtha cracking centre in Korea, 860 KTA
- Biggest aromatics supplier in east Asian region, 3 million MT)
- 9.6 billion USD annual revenue in 2015
- Polyolefin (PE, PP, EPDM) supplier









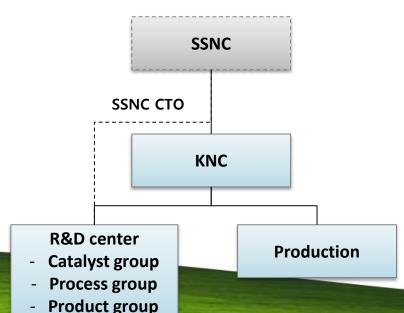
* Global expansion with multiple production sites





SSNC R&D Center





- > Established Jul. 2015
- Vision: economically competitive, reliable, Nexlene process for the production of benchmark and new, high value, differentiated polyethylene plastics, plastomers and elastomers.
- Role: Improvement and expansion of Nexlene technology, technical support to production and development of new grades
- institutes

 Collaboration and cooporation with various research

History of SSNC

Technology development

- Developed catalyst and process
 - Pilot plant in 2006

Commercialization

- 230 KTA capacity. Ulsan Korea, from 2014
- High premium polyolefin products with Nexlene technology

Leading global supplier (SSNC)

 New expansion programs under consideration

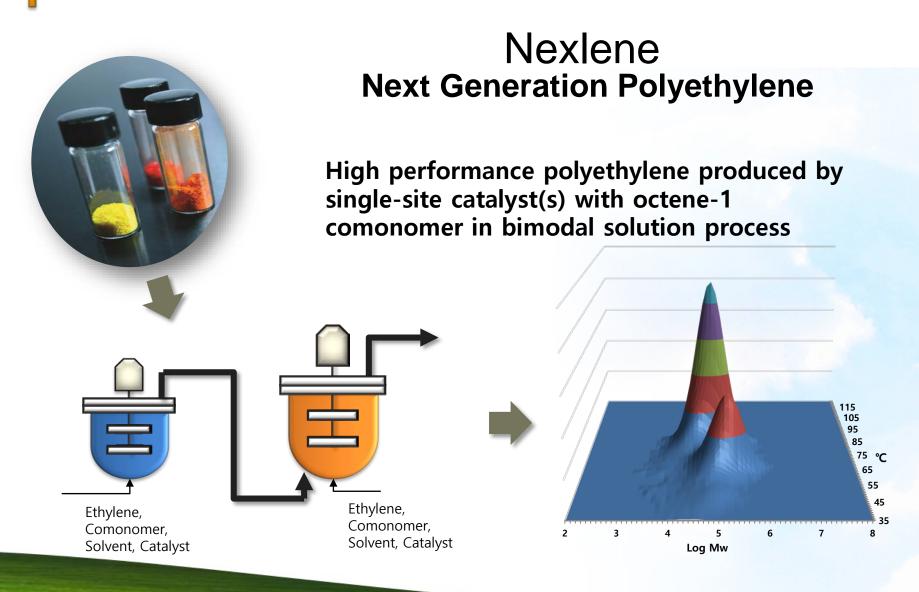




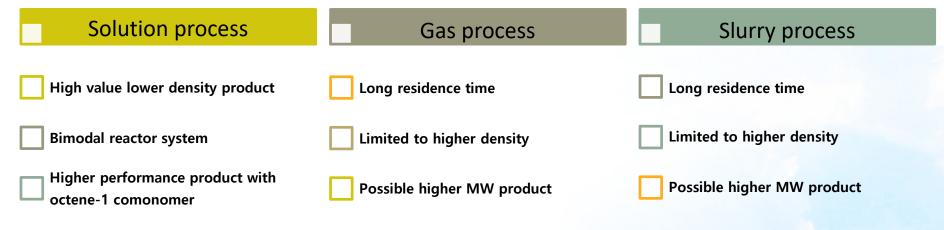
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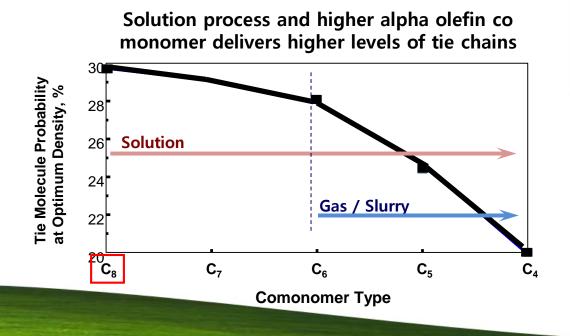
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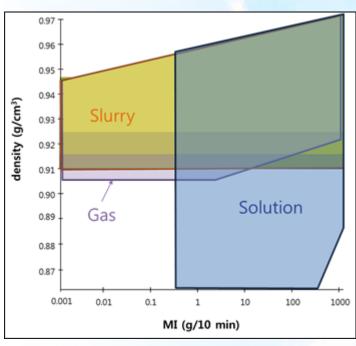
What is Nexlene?



Nexlene Process







Accelerating Nexlene catalyst evolution?

✓ High throughput screening

Structure-property relationship

Third party collaboration

SSNC R&D

- ✓ Scale-up and Commercialization
- Continuous polymerization unit
- Demo plant in Ulsan
- Commercial plant in Ulsan

SSNC Plant



High throughput synthesis



✓ Synthesis and Optimization

Universities

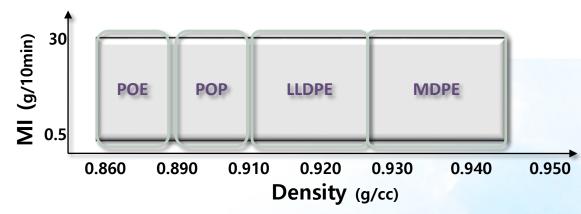
- Synthesis of more than 100 kinds of metallocenes
- Know-how in Organic and Inorganic synthesis

Nexlene Products

Product Range

➤ MI: 0.5 ~ 30

Density: 0.857 ~ 0.945





Characteristics of Nexlene Film Grades

• Excellent impact resistance

• Lower shrinkage

• Thinner & lightweight



- Compatible with most polyolefins
- · Recyclable for environment
- · Easy handling

Nexlene™ Delivers

- Enhanced Toughness
- Low Heat-seal Temp.
- Downgauging
- Low Extractables
- Excellent bubble stability

Characteristics of Nexlene POP products

Enhanced Toughness, Excellent Hot-tack & Seal Initiation Temperature, Superior Transparency

Application

Packaging Film

Stretch Hood, Shrink Film, Silage Film

Enhanced Toughness Excellent Hot Tack Strength Superior Transparency

Special Film

Thermal Lami, Foam

Decrement of Load and Pressure Enhanced Toughness

Industrial Film

Waterproof Sheet, Protective Film, Air Cap

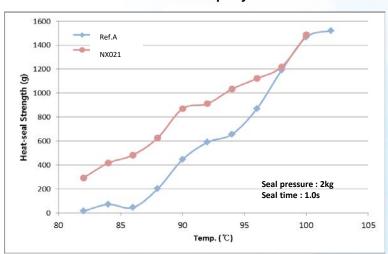
Enhanced Tensile / Tear Strength Excellent Impact Strength Decrement of Load and Pressure

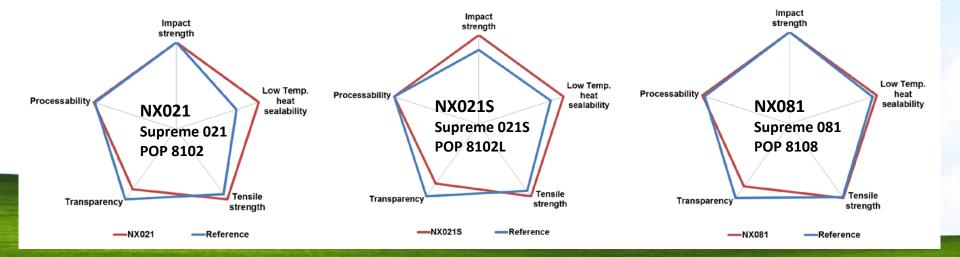
Food Specialty Packaging Film

Barrier Film, Stand Up Pouch, Snack, Processed Meat Packaging

Decrement of Load and Pressure Enhanced Toughness

Heat-seal Property

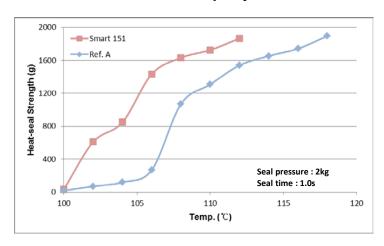




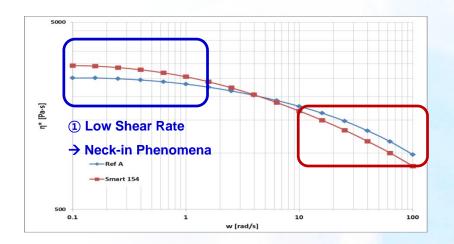
Characteristics of Nexlene mLLD products

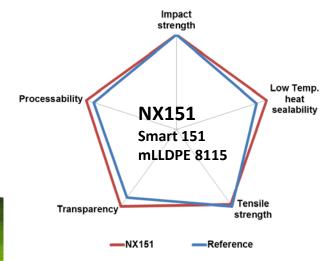
- Superior <u>Low Seal Initiation Temp., Processability and Transparency</u>
- Excellent <u>Impact Resistance</u>

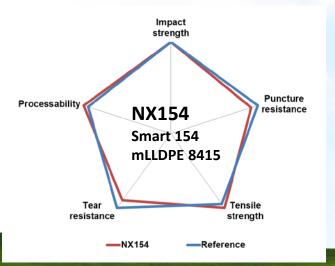
Heat-seal Property



Rheological Property







Characteristics of Nexlene POE products

- Excellent impact strength, flexural modulus, toughness and low temperature ductility
- Better physical properties than C4 POE



Automobile

Bumper / Grille

PP (60~65%) + Mineral (10~15%) + POE (15~25%)



Side Sill Panel

PP (60~65%) + Mineral (10~15%) + POE (15~25%)



Instrument Panel

PP (60~65%) + Mineral (10~15%) + POE (15~25%)



Door Trim

PP (65~70%) + Mineral (10~15%) + POE (10~15%)

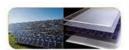


NVH

(Noise, Vibration, Harshness)

High filler loading, Light weight and Processibility





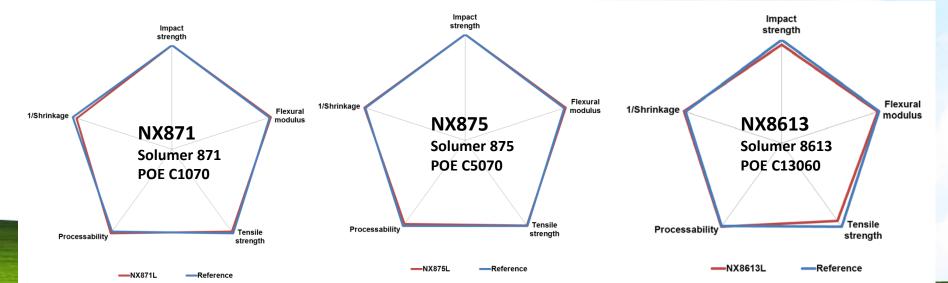
Encapsulant of solar cells

No lamination defects, Moisture-resistance, Weather-resistance



Wire & Cable

Easy processing, High e-resistivity and Heat resistance



Nexlene mMDPE

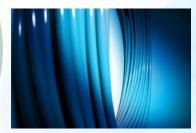
✓ Nexlene process has high potential in various MDPE applications (~0.945 density)

- Impact/stiffness balance
- Creep property
- ESCR
- Processability



- PE-RT (underfloor heating)
- Pressurized pipe









Film

- Heavy duty
- Shrink

Roto molding

- Chemical tank
- Sports & Leisure



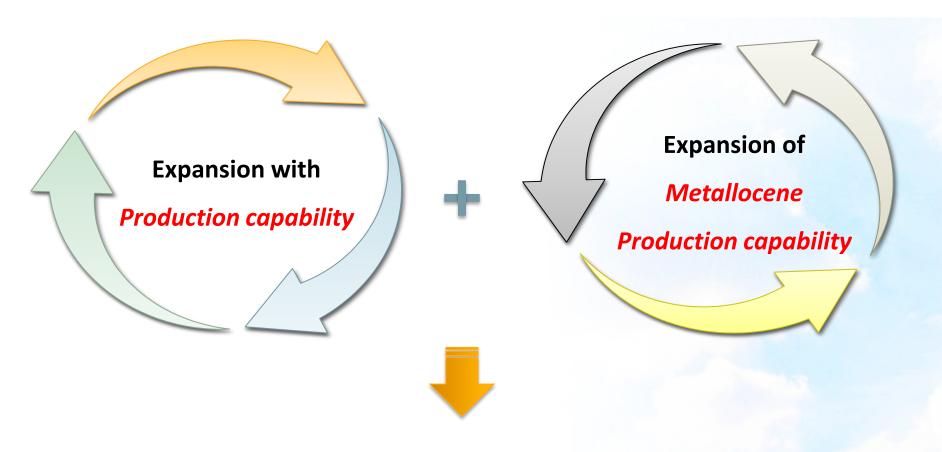
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Megatrends



Capability of Nexlene Technology



SUPPLIER OF CHOICE FOR NEXT GENERATION PO

Expansion with production capability

✓ SSNC is planning to launch new differentiated polyolefin products to the marketplace by focusing on novel catalyst and process technology and delivering value to our customers globally.

Advanced POE with bimodality

Better impact strength / modulus balance for automotive application

Well balanced elasticity / heat resistance as an elastomer

Advanced POP with molecular design

Better heat-seal and hot tack performance for food packaging



Elastomer with high flowability

POE for hot melt adhesives





Expansion of Metallocene Technology Platform

✓ SSNC is planning to launch new olefin based polymer (beyond PE) introducing new monomer/comonomer and molecular architecture control.

Room temperature Tg plastomer

Replacement of f-PVC, healthcare, and soft touch applications Elastomer with enhanced UV stability

Elastic material for outdoor applications

Elastomer with improved heat resistance

New olefin based elastomer with better heat resistance and durability







Thank you for your attention!