

# Next Generation Materials Co., Ltd

NANOTECHNOLOGY

RESEARCH(IP)

PRODUCT MANUFACTURE



CEO & Prof. Hansang KWON

## Disclaimer

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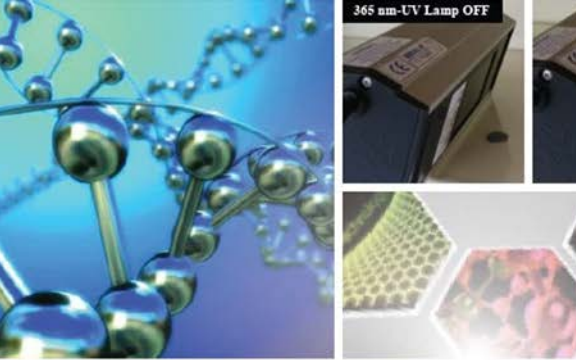
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Be Smart for The Materials Design  
and Engineering!

Our Scientists can open a new future for  
the engineering materials.

We created a new material dreams into reality.

NEXT GENERATION MATERIALS CO., LTD



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*Next Generation Materials Co., Ltd*



# CEO Greeting

We specialize in the advanced materials and engineering parts. We have established ourselves as a leader in the engineering materials market with technical expertise and quality innovation, aiming for the highest quality prompt response to customer needs and satisfaction. Our proprietary brand, functionally graded nanocarbon powder and composite materials are crucial in the manufacturing processes of almost all engineering material products. With our technology expertise that allows us to perform the entire manufacturing process from raw material design and controlling, fabricating and new evaluation method, we are able to provide expedited delivery ahead of our competitors.

Next-Generation Materials Co., Ltd.(NGM) will continue to develop cutting-edge materials and technology. Based on the corporate philosophy of respect for human and environment-conscious, we will do our best to support all customers. We thank you for your consistent encouragement and interest in NGM, an intrepid market leader in material science and innovation.

CEO. Dr. Prof. *Hansang Kwon*



## History of Next Generation Materials Co., Ltd

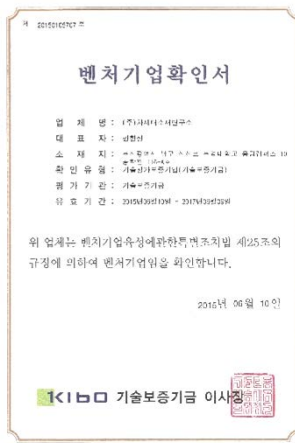
- 2019.02 Completion of extrusion factory (Yeongcheon, 1,800ton)
- 2018.11 Investment in the Korea technology finance corporation (\$1.5M, Post-money Value \$ 10M)
- 2018.03 EXIT the research institute & EXIT the PKNU technology holding company
- 2017.11 Selected as U-Tech valley (The Korea technology finance corporation: \$ 2M)
- 2017.08 Approval of exclusive department for research and development
- 2015.12 Elected as outstanding Researcher & Research Company by INNOPOLIS Foundation
- 2015.02 Elected as a Research Company by Ministry of Science and ICT
- 2014.12 Elected as a Venture Enterprise by Small & Medium Size Company Agency
- 2014.12 Established Next-Generation Materials Co., Ltd.



# Next Generation Materials Co.,Ltd.

NGM Co.,Ltd.

- Company : (주)차세대소재연구소 (Next Generation Materials Co.,Ltd.)
- Established : December 23, 2014
- Business : Industrial material production and R & D  
(Manufacturing of hybrid materials, licensing and prototype services, parts and materials trade)
- Scale: Laboratory (Busan, 100m<sup>2</sup>)/ Office (Busan, 60m<sup>2</sup>)/ Factory (Yeongcheon, 3,305m<sup>2</sup>)
- Construction equipment: 20 parts of material manufacturing equipment



○ 예비벤처기업확인서 (벤처기업육성에 관한 특별조치법)



○ 사업자등록증 (법인사업자)



- Manufacture of powder metallurgy products and technical consulting
- Manufacture and sale of hybrid materials
- Prototype production business
- Corporate research and service business
- Professional training for materials
- Overseas institutional collaborative research projects in related fields
- Technology transfer / licensing business





# Business Model



## NANOTECHNOLOGY



## RESEARCH (IP)



## PRODUCT MANUFACTURE

- Powder material professional training
- Composite and behavior analysis of dissimilar materials
- Light weight high strength functional composites
- Nano carbon parts material

분말 프로세스 기반 나노 이종 복합소재 제조 기술  
나노 이종 복합소재 물성 제어 기술

- R & D and intellectual property rights
- Technology transfer and licensing
- Network with parts and material manufacturers
- Secure core technology IP
- Material component companies and global joint research
- Source material research service

복합 소재 제조 공정 개발  
다기능성 이종 복합 소재 성능 향상 연구  
R & D 및 지적 재산권  
기술 라이선싱

- Nanocarbon (CNT, Graphene, Nanoparticles) composite powder
- Ultra-lightweight, high-strength nano-carbon metal matrix composite
- Functionally graded composite powder and composites
- Cemented carbide, heat dissipation material, thermoelectric material, etc.
- Spark plasma sintered dissimilar nanocomposites
- Hot extruded functionally dissimilar nanomaterials

다기능성 이종 복합소재 제품 생산  
나노 복합소재 제품 생산



# NGM's spot & equipment



## Plan

Establish business expansion plan

2017.06



## National agency loan (2billion)

The Korea Technology Finance Corporation

2017.11



## Searching

Factory Sites and Factory Establishment Approval Procedure

2018.06



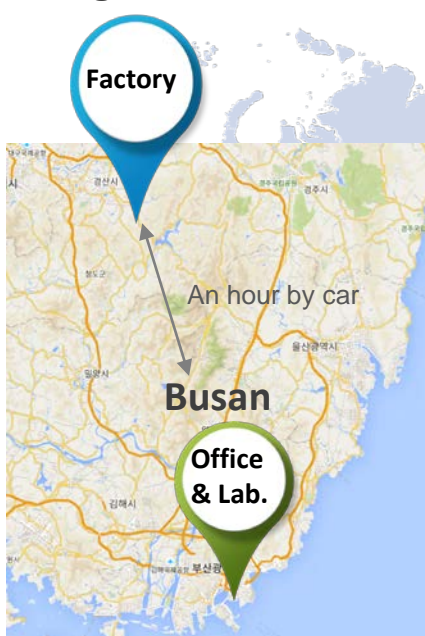
## Construction

Construction of industrial equipment

2018.08  
Construction completed on 2019.01.31.

**KIBO** 기술보증기금

## Yeongcheon



1,800 tons of extrusion equipment

in February 2019

(Industrial Complex 3,305 m<sup>2</sup> lease)



# Next Generation Materials Co.,Ltd.

## Stockholder's list

- Name of company: Next Generation Materials Co., Ltd.
- Capital: 120,000,000 WON
- Name of Representative: Hansang Kwon

Name of Stockholder 주주명	No. of Shares 주식수	Percentage (%) 지분율
Hansang Kwon 권한상	12,000	50.0
Eunseong Kwon 권은성	2,573	10.72
Hyunjin Jeon 전현진	1,427	5.95
Minwoo Jang 장민우	4,000	16.67
Korea technology finance corporation 기술보증기금	4,000	16.67
Total	24,000	100





# Trend of World Wide Materials Market



Lightweight  
초경량

The lighter the material,  
the more **infinite possibilities** exist for the application of the industry.



Strongest  
고강도

The material must have **suitable strength**  
to apply to the structure.



Multi  
Functionality  
다기능성

Multifunctional materials are the materials that  
perform multiple functions in a system due to  
their specific properties.



Energy-Saving /  
Eco-Friendly  
환경친화형

It is necessary to develop materials to  
**save energy and resources** and  
respond to environmental regulations.



Low Price  
가격경쟁력

Best price promise

[요약]  
지구온난화의 주범인 이산화탄소 배출을 저감 시키기 위해  
전세계적으로 다양한 정책과 협약이 진행되고 있는 실정이며  
특히 소재의 관점으로 볼 때 다기능성 소재를 적용하는 것만으로도  
에너지 절감이 가능한 만큼 그 역할이 기대됨!

## Trends in global CO<sub>2</sub>-emissions policy

UN Framework Convention on Climate Change (UNFCCC) : 1992

Kyoto Protocol : 1997

The adoption of the landmark Paris Agreement on Climate Change  
by 194 countries and the European Union : 2015



# New Strategy

## Dissimilar Metal Matrix Composite Materials

이종 금속 복합재료

- Simultaneous implementation of the advantages of each material (excellent mechanical properties, corrosion resistance and light weight)
- Development of eco-friendly composite materials by applying low-energy / low-carbon solid-phase powder metallurgy process
- It is possible to supply material optimized for application as composite material, thus reducing cost and improving performance

각 소재의 장점 (우수한 기계적 특성, 방열성 및 경량성) 동시구현

복합 소재로서 응용 분야에 최적화된 재료의 공급이 가능해 원가절감 및 성능향상

저에너지/저탄소 발생 소성가공 공정을 적용하여 친환경 복합재료 개발

### A Material

LIGHTWEIGHT  
WORKABILITY  
LOWER COST



### B Material

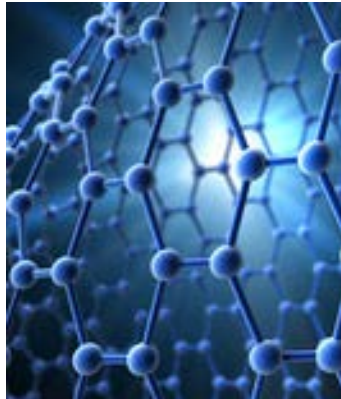
CORROSION RESISTANCE  
MECHANIAL PROPERTY  
ELECTRICAL PROPERTY  
THERMAL PROPERTY



**Multi Functionality !**

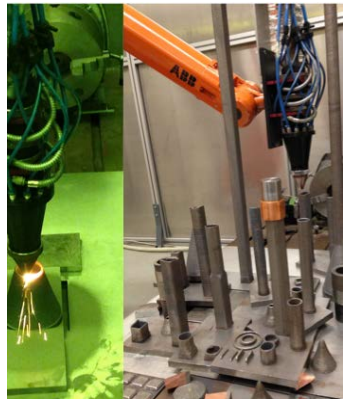


# Core Technology



## Nano composite

Nanocomposite is a multiphase solid material where one of the phases has one, two or three dimensions of less than 100 nanometers (nm), or structures having nano-scale repeat distances between the different phases that make up the material.



## Dissimilar material

Emerging trends in manufacturing such as light weighting, increased performance and functionality increases the use of multi-material, hybrid structures and thus the need for joining of dissimilar materials.



## Functionally graded materials

The materials can be designed for specific function and applications.

## Method of Plastic Deformation

### • Powder Metallurgy

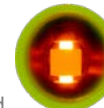
Depending on the type of material, size and geometry of the object, and the forces applied, various types of deformation may result.



압출

### Extrusion

Extrusion is a process used to create objects of a fixed cross-sectional profile. A material is pushed through a die of the desired cross-section.



소결

### Sintering

Sintering is the process of compacting and forming a solid mass of material by heat or pressure without melting it to the point of liquefaction.



성형

### Compaction

Powder compaction is the process of compacting metal powder in a die through the application of high pressures.



접합

### Bonding

Diffusion and explosive bonding perhaps provides the best strength and interfaces between metals.



# Core Technology

## 분말 설계

### Powder recipe

Advanced material choices with powder metallurgy  
Algorithm development of powder design  
Powder fabrication process design

## 특수 빌렛 설계

### Special billet design

Selection of the desired various shape and properties  
Algorithm development of powder & tube design  
Novel billet fabrication process design

## 압출 공정 최적화

### Development of extrusion process

Optimized for better control of material flow during co-extrusion of special billets  
Design of mass production and extrusion methods for custom manufacturing  
Extrusion process design for cost reduction and high performance

## EXTRUSION SYSTEM

## SPARK PLASMA SINTERING SYSTEM

## 스파크플라즈마 소결 공정 최적화

### Development of spark plasma sintering process

Optimized for better control of bulk process of composite powder  
Design of Manufacturing method for FGM  
Sintering process design for high performance composite materials

## 특성제어

### Properties control

Multifunctional control  
Fabrication of high performance materials through interface control  
Design of advanced materials

## 제품

### Production

Superclad Tube & Wire & Bar  
Superclad Profile & Heatsink  
Aluminum Composites Materials  
Functionally Graded Materials  
Energy harvesting Materials  
Etc.



# Manufacturing of general clad materials

One of the greatest advantages of clad metals is the reduced material and fabrication cost.

클래드 메탈은 이중 소재의 특성이 조합된 금속

## Conventional clad material manufacturing method

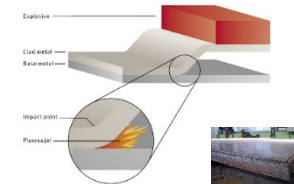
### Hot roll Bonding



#### 열간 압연

Clad metal with various structures  
Thickness control by post-treatment process

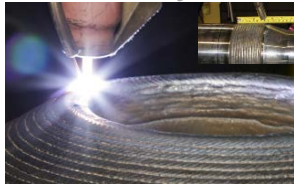
### Explosive Bonding



#### 폭발 접합

Control of Backer, Cladder, Explosive, Velocity  
Thickness control by post-treatment process

### Weld Overlay



#### 오버레이 용접

Control of heat input, velocity, and material  
Thickness control by post-treatment process

### Friction welding



#### 마찰 용접

Control of heat input, velocity, and material  
Thickness control by post-treatment process

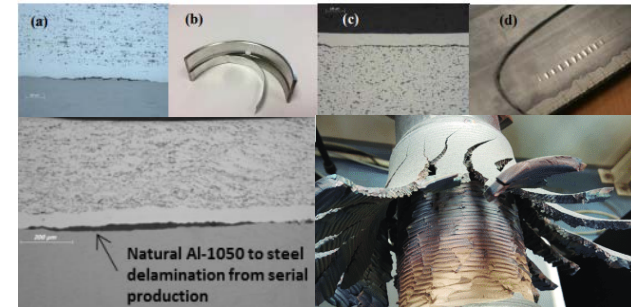
## Features of conventional manufacturing process



### 품질

#### Quality

Difficult to control the physical properties based on the melting of the interface



### 경제성

#### Economics

Requires a lot of process  
Expensive production price



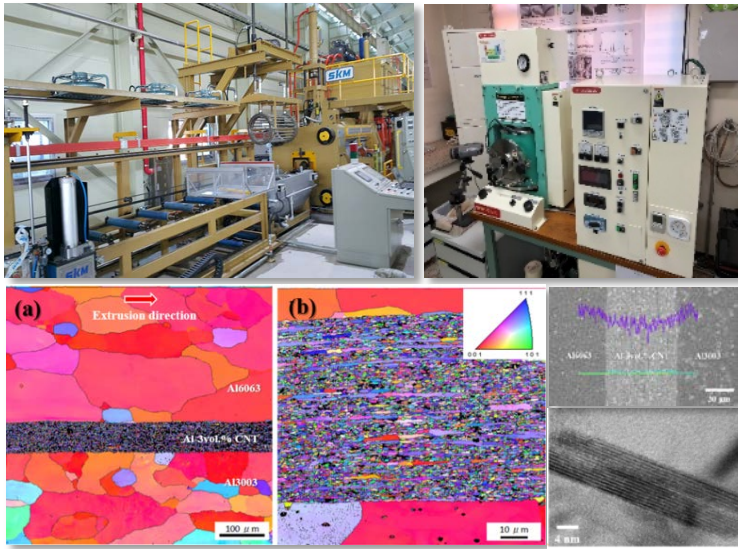


# Next Generation Technology

Next generation technology capable of manufacturing high-performance dissimilar materials that are not possible with conventional methods

차세대 제조 공정 기술의 높은 경제성과 고성능화

## World-class technology



자체 솔루션 / 맞춤형 다기능 고성능 재료

- Controls of material properties through interfacial property
- Customized multi-functionally high performance materials
- Next generation Extrusion & Spark Plasma Sintering processes

## Next generation powder metallurgy process



고기능성

**High functionality**

Mechanical properties  
Thermal properties  
Electrical properties  
Physical Characteristics  
Lightweight



철, 비철 및 비금속 재료

**Manufacture of various materials**

Iron and/or non-ferrous  
and/or non-metallic  
materials



품질 안정성

**Stable quality**

Decrease defect rate  
Good reliability



경제성

**Economics**

Reduce material cost and  
shorten the processing time



친환경성

**Eco friendly**

Low energy consumption  
Low CO<sub>2</sub> emissions



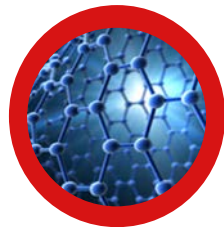
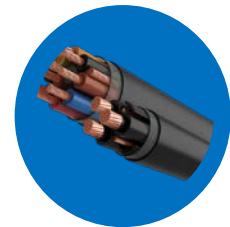
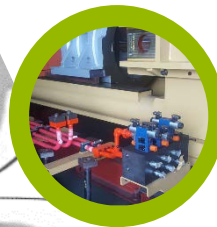
적용

**Various applications**

Whole industry



# Superclad by Advanced Extrusion Process



- Core/Clad Structured Metal Profiles
- Lightweight Materials
- High Strength
- High Corrosion Resistance
- Functional Composite Materials
- Multi Billet Extrusion and Process

# Superclad Materials

## The Superclad products overcome the limitations of conventional clad materials

기존 클래드 제품의 한계를 극복한 슈퍼클래드 제품

### Profiles



Profile



Heatsink



Plate bar

High Structural Strength  
Lightweight  
High Thermal Conductivity  
Corrosion Resistance  
Mechanical Property  
Electrical Property

#### Application Product

Building Material  
Frame Industry  
Radiation Shielding Material  
Industrial Robots  
Solar System Parts

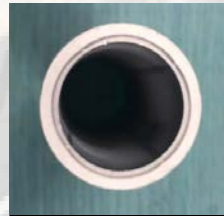
### Tubes



Pipe



Camera body



Hydraulic cylinder

High Structural Strength  
Lightweight  
High Thermal Conductivity  
Corrosion Resistance  
Mechanical Property  
Electrical Property

#### Application Product

Building Material  
Radiation Shielding Material  
Industrial Robots  
Air Or Hydraulic Cylinder  
Automotive Parts

### Rods



Rod



Wire



Electric cable

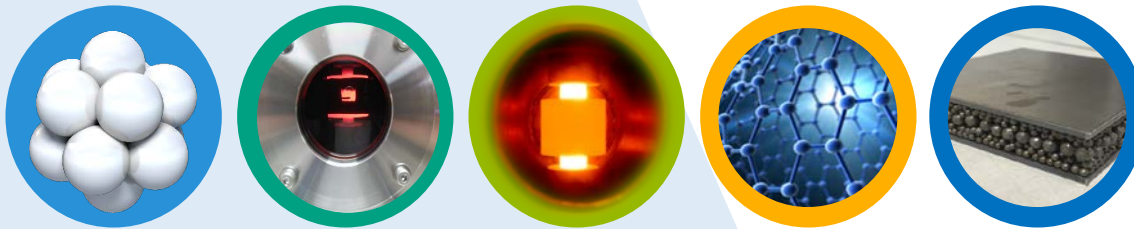
High Structural Strength  
Lightweight  
High Thermal Conductivity  
Corrosion Resistance  
Mechanical Property  
Electrical Property

#### Application Product

Building Material  
Radiation Shielding Material  
Industrial Robots  
Electric Cable  
Aerospace Industry



# Superclad by Spark Plasma sintering



- Material Design and Control
- Multi Billet Extrusion and Process
- Spark Plasma Sintering (SPS)
- Functionally Graded Materials (FGM)
- Junction of Dissimilar Materials





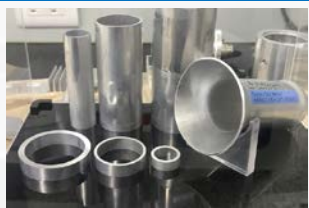
# Superclad Materials

## Customized Multi Dissimilar Materials

맞춤형 다기능 이종복합재료

### AlAl

Aluminum&Aluminum



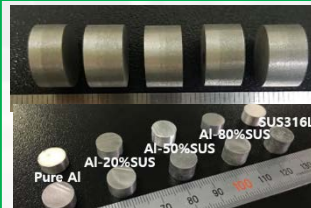
High Strength  
Lightweight  
High Thermal Conductivity  
Corrosion Resistance  
Mechanical Property

#### Application Product

Aluminum Parts/ Vehicle Parts  
Electronics case/ Industrial Parts  
Solar System Parts

### AlSus

Aluminum&Stainless steel



High Strength  
Lightweight  
Corrosion Resistance  
Mechanical Property  
Electric Property

#### Application Product

Aluminum Parts/ Vehicle Parts  
Electronics case/ Industrial Parts  
Aerospace Industry/ Electric Parts

### AlCopper

Aluminum&Copper



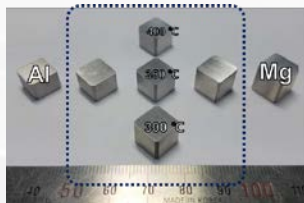
High Strength  
Lightweight  
High Thermal Conductivity  
Corrosion Resistance  
Mechanical Property

#### Application Product

Aluminum Parts/ Vehicle Parts  
Electronics case/ Industrial Parts  
Heat-dissipating Parts/ Metal PCB Parts

### AlSiMg

Aluminum&Magnesium



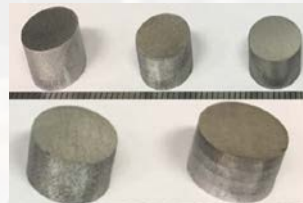
High Strength  
Lightweight  
High Thermal Conductivity  
Corrosion Resistance  
Mechanical Property

#### Application Product

Aluminum Parts/ Vehicle Parts  
Electronics case/ Industrial Parts  
Heat-dissipating Parts/ Metal PCB Parts

### AlTitanium

Aluminum&Titanium



High Strength  
Lightweight  
High Thermal Conductivity  
Corrosion Resistance  
Mechanical Property

#### Application Product

Vehicle parts/ Frame Industry  
Aerospace industry/ Industrial Robots  
Bio-metal materials

### Metal-Ceramic-Polymer

Metal&ceramic&Polymer



High Strength  
Lightweight  
Corrosion Resistance  
Mechanical Property  
Electric Property

#### Application Product

Vehicle parts/ Electronics case  
Aluminum parts/ Industrial Parts  
Solar System Parts

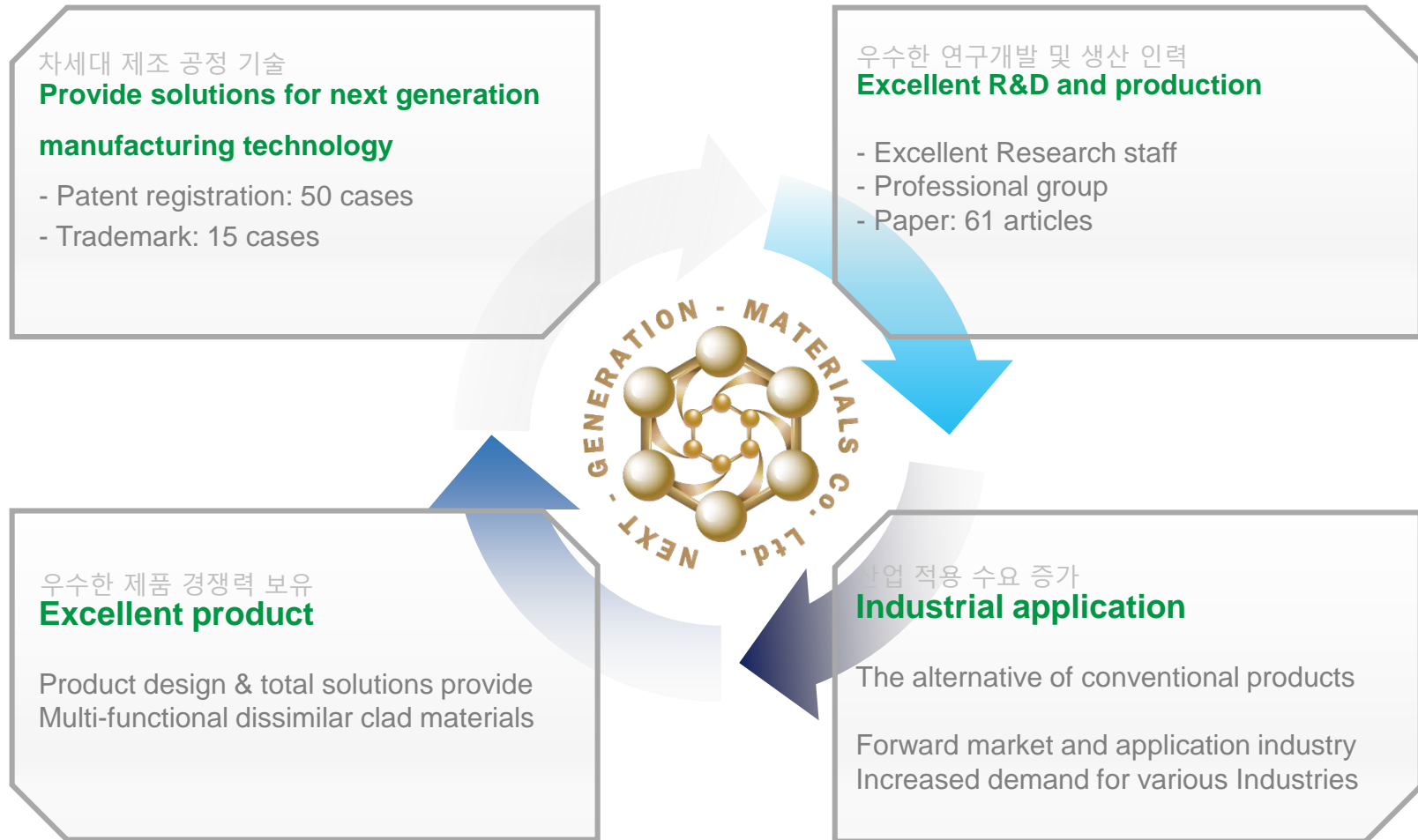




# NGM's with excellent technology

## Barriers to entry in business based on advanced technology

신기술 기반의 진입장벽 구축



# Growth Potential

## Next Generation Materials Co., Ltd Specializes In Dissimilar Composite Advanced Material

기존 소재 대체 뿐만 아니라 새로운 적용 산업 분야의 확대 기여



### STABILITY

안정성

Surplus management realization



### GROWTH

성장성

CAGR 43% (2016~2018)



### PROFITABILITY

수익성

OP margin

#### Technology

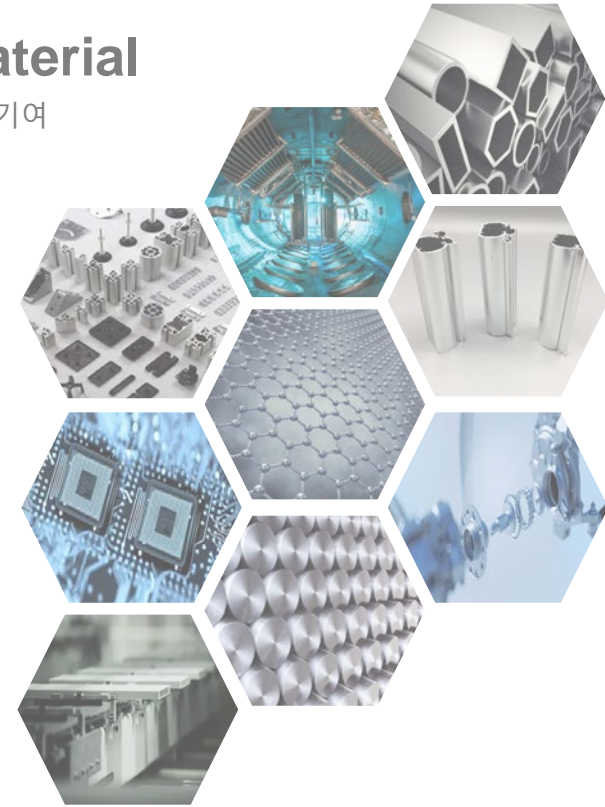
Obtain original technology of advanced manufacturing process of dissimilar material

#### Competitiveness

Our dissimilar material manufacturing technology and high performance products are the only in the world

#### Commercialization

Practical business based on source technology



# Growth strategy

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## Future growth strategy

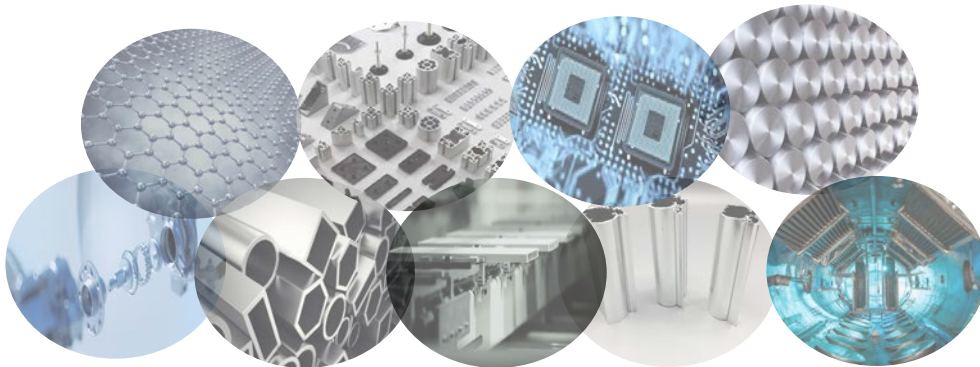
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Business Status

Business Model

Next Generation Materials Co.,Ltd.

Milestone



# Domestic Export Status for Materials Industry

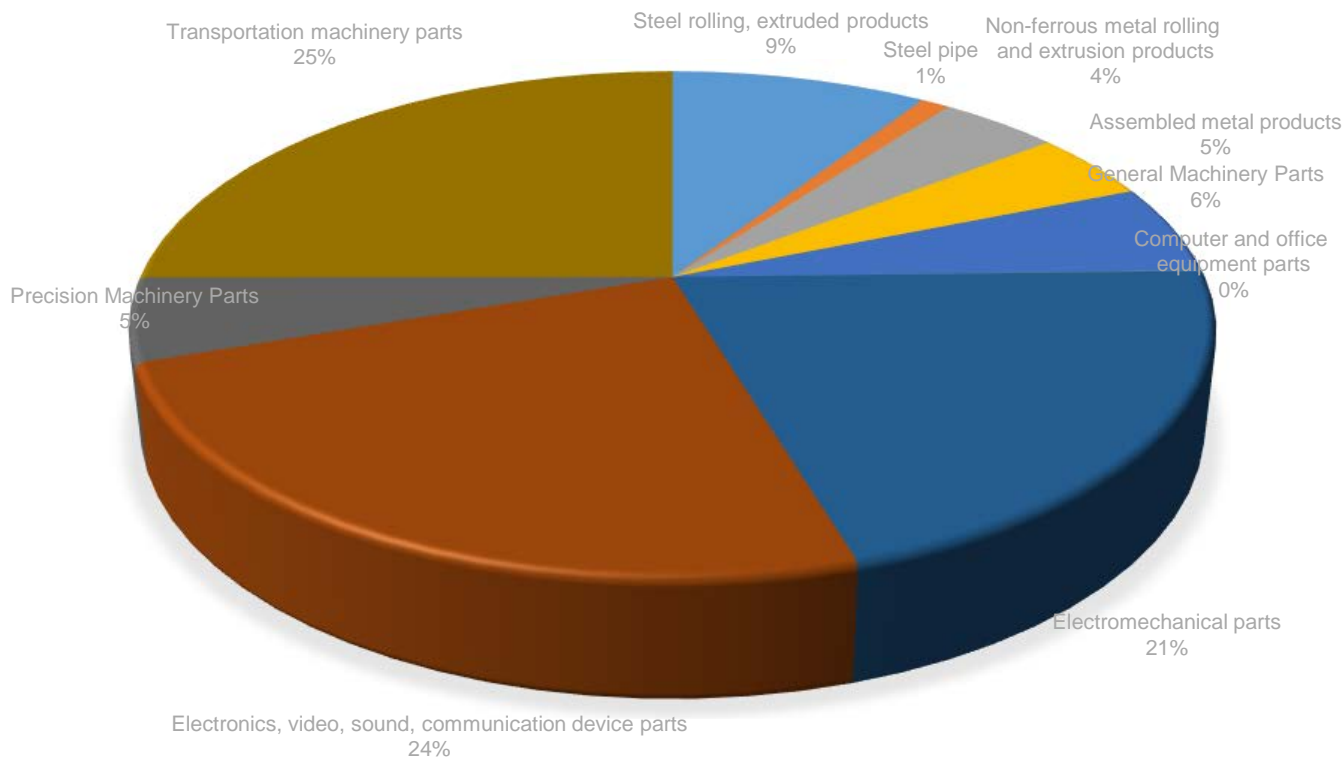
## Growth potential of next-generation materials

**Aluminum-based parts and products account for a large share of exports.**

**The Next Generation Materials products are expected to account for 0.1% of Korea's export volume.**

Average domestic export amount  
About \$ 110,000,000,000

Share of 0.1%  
About & 110,000,000



\* 2015~2017 KOSIS



# Business Status

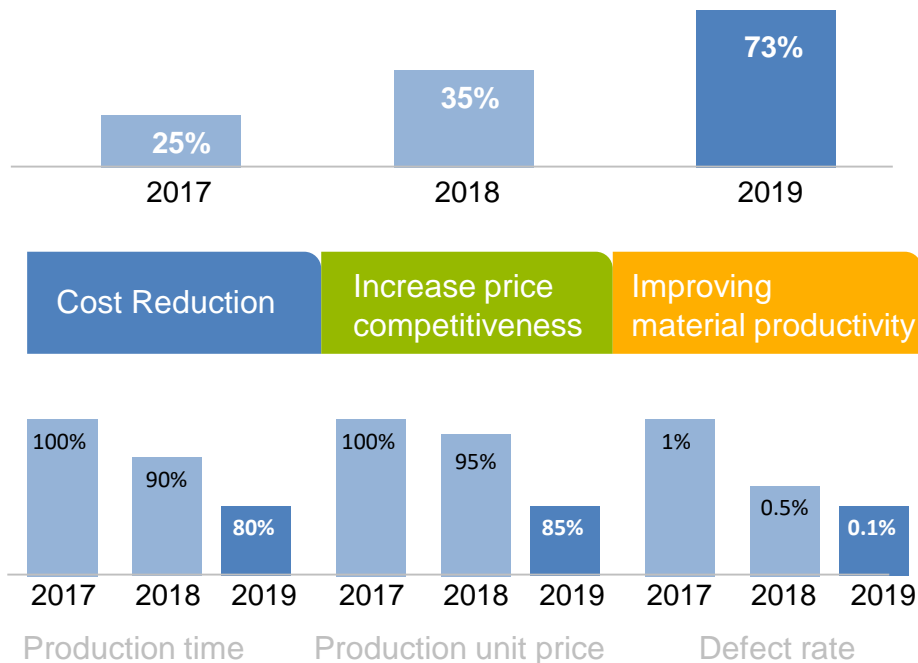
## The Advantage of Next Generation Technology for clad materials

One of the greatest advantages of clad metals is the reduced material and fabrication cost.

### Improve production efficiency

경량성 확보

Light weight improvement



### Better profitability



원자재 비용 감소

**Raw material cost reduction**

Decreased defect rate,  
high performance



성능 향상

**Performance improvements**

Optimize material design  
Manufacturing process optimization



안정성

**Stable quality**

Decrease defect rate



경제성

**Economics**

Reduce material cost and  
shorten the processing time



생산 설비 구축

**Production facility construction**

Securing own production line  
Process control enhancement



산업 적용

**Various applications**

Forward industry,  
transportation equipment industry,  
electronic and electric parts, etc.

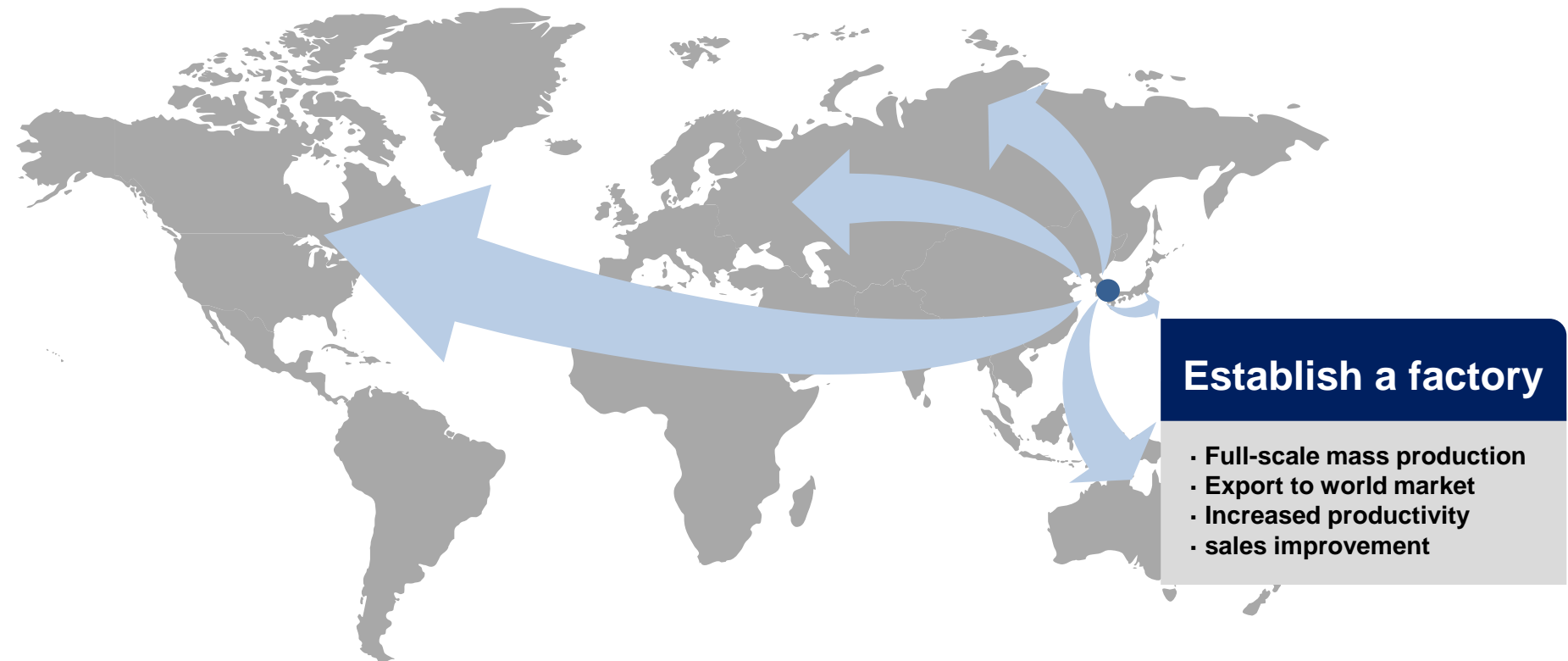




# Business Expand Model

## Expansion of business through the acquisition of production facilities and securing of global headquarters

Next Generation Materials Co.,Ltd. R&D center was established in 2014 and has continuously developed new technologies to achieve the best quality in metal powders, Superclad materials, conductive materials, EMC products, powder metallurgy, and Supercomposite materials.



# Next Generation Materials Co.,Ltd.



## CEO Hansang Kwon

(Professor, Dept. of Materials System Engineering , Pukyong National University)

### Scientist in Advanced materials processing, EMPA in Switzerland (11 ~ 13)

- R & D of nano powder and nano-carbon metal/ceramic composite material
- R & D on Nano Carbon Fusion Gradient Lightweight Bulletproof Material
- R & D of ultra-light and high-strength nano-fusion composite material
- R & D of high strength inclined cemented carbide

### Senior researcher in convergence components and materials

research group KITECH (10 ~ 11)

- R & D of lightweight high-strength functional fusion material parts

### Researcher in Composite Materials group, ICMCB-CNRS in France (09 ~ 10)

- R & D of nano powder and nano-carbon metal/ceramic composites
- R & D of high heat-resistant diamond-reinforced metal/ceramic composite heat dissipation material for satellite

### Ph.D. in Materials Science and Engineering - Tohoku University (05 ~ 08)

- R & D of nano powder and nano-carbon aluminum composite material

**Others:** Current International scientific committee member of FGM

Carbon Industry Development Forum Professional Advisor, Gyeongsangbukdo etc.

✓ R & D

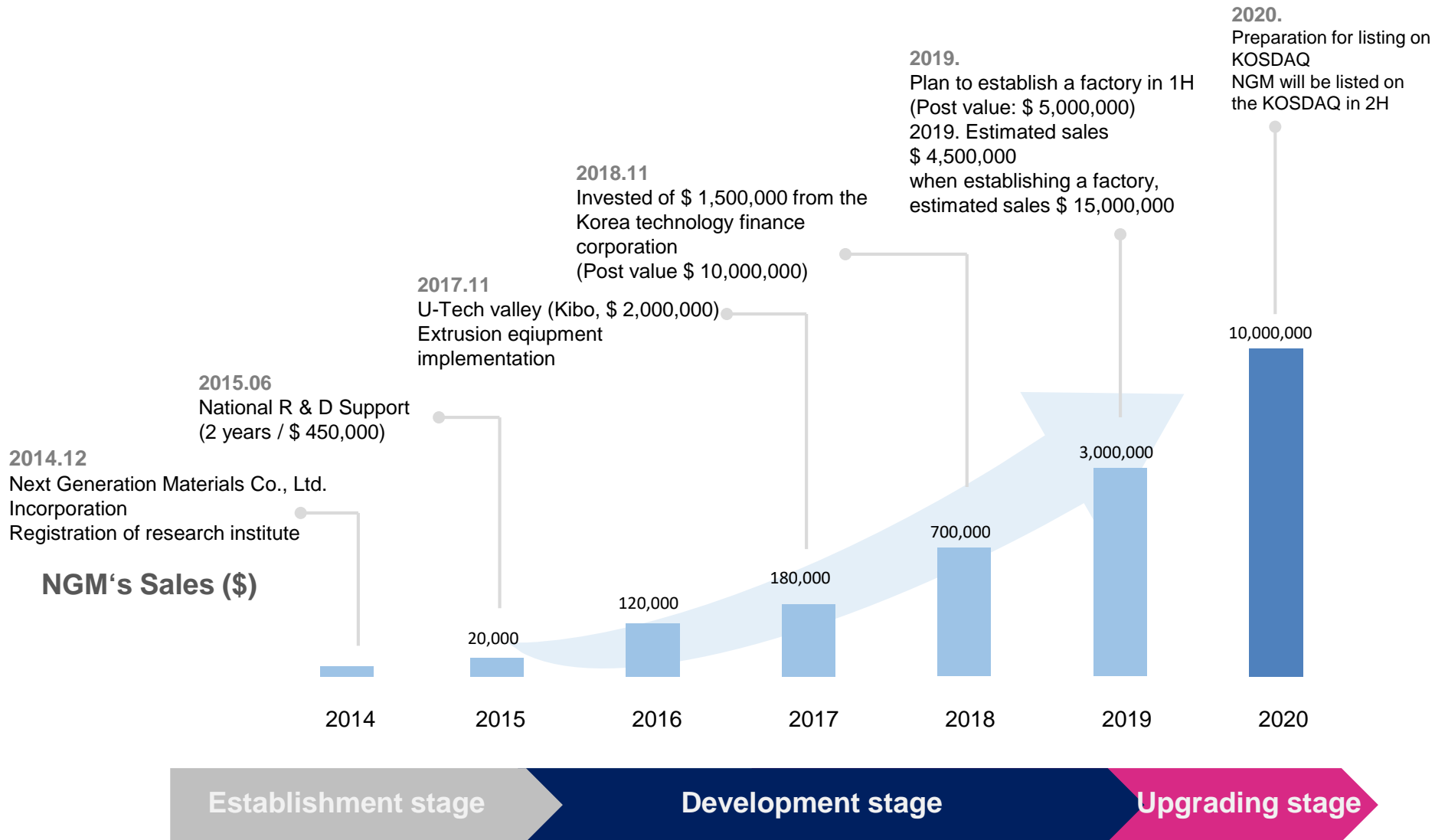
✓ Business executive

✓ Strategy/Planning

✓ Management/Operation



# Milestone





# Next Generation Materials (주) 차세대소재연구소

NANOTECHNOLOGY

RESEARCH(IP)

PRODUCT MANUFACTURE

[www.ngm.re.kr](http://www.ngm.re.kr)

<http://cms.pknu.ac.kr/kwon13>



Thank you  
for your attention !

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