

# The Global Market for Antimicrobial, Antiviral and Antifungal Nanocoatings 2022-2032

<https://marketpublishers.com/r/GB4AF83B20CAEN.html>

Date: February 2022

Pages: 342

Price: US\$ 1,100.00 (Single User License)

ID: GB4AF83B20CAEN

## Abstracts

The global COVID-19 crisis has greatly increased industry demand for antimicrobial and antiviral coatings, especially for high touch surfaces in healthcare, retail, hotels, offices and the home.

Nanocoatings can demonstrate up to 99.9998% effectiveness against bacteria, formaldehyde, mold and viruses, and are up to 1000 times more efficient than previous technologies available on the market. They can work on multiple levels at the same time: anti-microbial, anti-viral, and anti-fungal, self-cleaning and anti-corrosion. Nanocoatings companies have partnering with global manufacturers and cities to develop anti-viral facemasks, hazard suits and easily applied surface coatings.

Their use makes it possible to provide enhanced antimicrobial, antiviral, mold-reducing and TVOC degrading processes, that are non-toxic and environmentally friendly, allowing for exceptional hygiene standards in all areas of work and life. As a result, it is possible create a healthier living and working environment and to offer holistic solutions to people with a diminished immune system. Nano-based surface coatings prevent the spread of bacteria, fungi and viruses via infected surfaces of so called high-traffic objects, such as door and window handles in public places, hospitals, public buildings, schools, elderly homes etc.

Antimicrobial, Antiviral, and Antifungal Nanocoatings are available in various material compositions, for healthcare and household surfaces, for indoor and outdoor applications, to protect against corrosion and mildew, as well as for water and air purification. Nanocoatings also reduce surface contamination, are self-cleaning, water-repellent and odour-inhibiting, reducing cleaning and maintenance

Antimicrobial, Antiviral, and Antifungal Nanocoatings can be applied by spraying or dipping and adhere to various surfaces such as glass, metals and various alloys, copper and stainless steel, marble and stone slabs, ceramics and tiles, textiles and plastics.

Nanoparticles of different materials such as metal nanoparticles, carbon nanotubes, metal oxide nanoparticles, and graphene-based materials have demonstrated enhanced anti-microbial and anti-viral activity. The use of inorganic nanomaterials when compared with organic anti-microbial agents is also desirable due to their stability, robustness, and long shelf life. At high temperatures/pressures organic antimicrobial materials are found to be less stable compared to inorganic antimicrobial agents. The various antimicrobial mechanisms of nanomaterials are mostly attributed to their high specific surface area-to-volume ratios, and their distinctive physico-chemical properties..

Antimicrobial, antiviral and antifungal nanocoatings applications include, but are not limited to:

Medical facilities and laboratories

Medical equipment;

Fabrics and clothing like face masks;

Hospital furniture;

Hotels and other public spaces;

Window glass;

Pharmaceutical labs;

Packaging;

Food packaging areas and restaurants;

Food processing equipment;

Transportation, air ducts and air ventilation systems;

Appliances;

Sporting and exercise equipment;

Containers;

Aircraft interiors and buildings;

Cruise lines and other marine vessels;

Restroom accessories;

Shower enclosures;

Handrails;

Schools and childcare facilities;

Playgrounds.

Report contents include:

Size in value for the Antimicrobial, Antiviral, and Antifungal Nanocoatings market, and growth rate during the forecast period, 2017-2032. Historical figures are also provided, from 2010.

Antimicrobial, Antiviral, and Antifungal Nanocoatings market segments analysis. End users markets include interiors (e.g. household, retails, hotels, workplace, business environments), sanitary, indoor hygiene, medical & healthcare, textiles, plastics packaging etc.

Size in value for the End-user industries for nanocoatings and growth during the forecast period.

Market drivers, trends and challenges, by end user markets.

Market outlook for 2022.

In-depth market assessment of opportunities for nanocoatings, by type and markets.

Antimicrobial, Antiviral, and Antifungal Nanocoatings applications.

Analysis of nanomaterials utilized in Anti-microbial, Anti-viral, and Anti-fungal surface treatments, coatings and films including

nanosilver

graphene

nanosilica

titanium dioxide nanoparticles/powders

zinc oxide nanoparticles/powders

nanocellulose

carbon nanotubes

fullerenes

copper oxide nanoparticles

iron oxide nanoparticles

gold nanoparticles

nitric oxide nanoparticles

iron oxide nanoparticles

boron nitride nanoparticles

magnesium oxide nanoparticles

aluminium oxide nanoparticles

organic nanoparticles

chitosan nanoparticles

2D Materials

Black Phosphorus.

Layered double hydroxides (LDHs)

Transition metal dichalcogenides (TMDs)

Graphitic carbon nitride (g-C<sub>3</sub>N<sub>4</sub>)

MXENE

Hydrophobic and hydrophilic coatings

Superhydrophobic coatings and surfaces.

In-depth analysis of antibacterial and antiviral treatment for antibacterial mask, filter, gloves, clothes and devices.

156 company profiles including products, technology base, target markets and contact details. Companies features include Advanced Materials-JTJ s.r.o., Bio-Fence, Bio-Gate AG, Covalon Technologies Ltd., EnvisionSQ, Fusion Bionic, GrapheneCA, Integricote, Nano Came Co. Ltd., NanoTouch Materials, Nanoveu, NBD Nanotechnologies, NitroPep, OrganoClick, HeiQ Materials, Green Earth Nano Science, Reactive Surfaces, Kastus, Halomine, Spartha Medical SAS, sdst, myNano, Voneco and many more.

## Contents

### 1 INTRODUCTION

- 1.1 Aims and objectives of the study
- 1.2 Market definition
  - 1.2.1 Properties of nanomaterials
  - 1.2.2 Categorization

### 2 RESEARCH METHODOLOGY

### 3 EXECUTIVE SUMMARY

- 3.1 High performance coatings
- 3.2 Nanocoatings
- 3.3 Anti-viral nanoparticles and nanocoatings
  - 3.3.1.1 Reusable Personal Protective Equipment (PPE)
  - 3.3.1.2 Wipe on coatings
  - 3.3.1.3 Facemask coatings
  - 3.3.1.4 Long-term mitigation of surface contamination with nanocoatings
- 3.4 Market drivers and trends
- 3.5 Market and technical challenges
- 3.6 Toxicity and environmental considerations
- 3.7 Impact of COVID-19 on the market

### 4 NANOCOATINGS TECHNICAL ANALYSIS

- 4.1 Properties of nanocoatings
- 4.2 Benefits of using nanocoatings
  - 4.2.1 Types of nanocoatings
- 4.3 Production and synthesis methods
  - 4.3.1 Depositing functional nanocomposite films
  - 4.3.2 Film coatings techniques analysis
  - 4.3.3 Superhydrophobic coatings on substrates
    - 4.3.3.1 Direct Laser Interference Patterning (DLIP)
  - 4.3.4 Electrospray and electrospinning
  - 4.3.5 Chemical and electrochemical deposition
    - 4.3.5.1 Chemical vapor deposition (CVD)
    - 4.3.5.2 Physical vapor deposition (PVD)

- 4.3.5.3 Atomic layer deposition (ALD)
- 4.3.6 Aerosol coating
- 4.3.7 Layer-by-layer Self-assembly (LBL)
- 4.3.8 Sol-gel process
- 4.3.9 Etching

## **5 NANOMATERIALS USED IN ANTI-MICROBIAL, ANTI-VIRAL AND ANTI-FUNGAL NANOCOATINGS**

- 5.1 Metallic-based coatings
- 5.2 Polymer-based coatings
- 5.3 Antimicrobial nanomaterials
- 5.4 GRAPHENE
  - 5.4.1 Properties
  - 5.4.2 Graphene oxide
    - 5.4.2.1 Anti-bacterial activity
    - 5.4.2.2 Anti-viral activity
  - 5.4.3 Reduced graphene oxide (rGO)
  - 5.4.4 Application in anti-microbial and anti-viral nanocoatings
    - 5.4.4.1 Anti-microbial wound dressings
    - 5.4.4.2 Medical textiles
    - 5.4.4.3 Anti-microbial medical devices and implants
- 5.5 SILICON DIOXIDE/SILICA NANOPARTICLES
  - 5.5.1 Properties
  - 5.5.2 Antimicrobial and antiviral activity
    - 5.5.2.1 Easy-clean and dirt repellent coatings
- 5.6 SILVER NANOPARTICLES (AgNPs)
  - 5.6.1 Properties
  - 5.6.2 Application in anti-microbial and anti-viral nanocoatings
    - 5.6.2.1 Textiles
    - 5.6.2.2 Wound dressings
    - 5.6.2.3 Consumer products
    - 5.6.2.4 Air filtration
    - 5.6.2.5 Packaging
  - 5.6.3 Companies
- 5.7 TITANIUM DIOXIDE NANOPARTICLES
  - 5.7.1 Properties
    - 5.7.1.1 Exterior and construction glass coatings
    - 5.7.1.2 Outdoor air pollution

- 5.7.1.3 Interior coatings
- 5.7.1.4 Improving indoor air quality
- 5.7.1.5 Medical facilities
- 5.7.2 Application in anti-microbial and anti-viral nanocoatings
  - 5.7.2.1 Air filtration coatings
  - 5.7.2.2 Antimicrobial coating indoor light activation
- 5.8 ZINC OXIDE NANOPARTICLES (ZnO-NPs)
  - 5.8.1 Properties
  - 5.8.2 Application in anti-microbial and anti-viral nanocoatings
    - 5.8.2.1 Sterilization dressings
    - 5.8.2.2 Anti-bacterial surfaces in construction and building ceramics and glass
    - 5.8.2.3 Antimicrobial packaging
    - 5.8.2.4 Anti-bacterial textiles
- 5.9 NANOCEULLOSE (CELLULOSE NANOFIBERS AND CELLULOSE NANOCRYSTALS)
  - 5.9.1 Properties
  - 5.9.2 Application in anti-microbial and anti-viral nanocoatings
    - 5.9.2.1 Cellulose nanofibers
    - 5.9.2.2 Cellulose nanocrystals (CNC)
- 5.10 CARBON NANOTUBES
  - 5.10.1 Properties
  - 5.10.2 Application in anti-microbial and anti-viral nanocoatings
- 5.11 FULLERENES
  - 5.11.1 Properties
  - 5.11.2 Application in anti-microbial and anti-viral nanocoatings
- 5.12 COPPER OXIDE NANOPARTICLES
  - 5.12.1 Properties
  - 5.12.2 Application in anti-microbial and anti-viral nanocoatings
  - 5.12.3 Companies
- 5.13 GOLD NANOPARTICLES (AuNPs)
  - 5.13.1 Properties
  - 5.13.2 Application in anti-microbial and anti-viral nanocoatings
- 5.14 IRON OXIDE NANOPARTICLES
  - 5.14.1 Properties
  - 5.14.2 Application in anti-microbial and anti-viral nanocoatings
- 5.15 MAGNESIUM OXIDE NANOPARTICLES
  - 5.15.1 Properties
  - 5.15.2 Application in anti-microbial and anti-viral nanocoatings
- 5.16 NITRIC OXIDE NANOPARTICLES



#### 5.16.1 Properties

#### 5.16.2 Application in anti-microbial and anti-viral nanocoatings

### 5.17 ALUMINIUM OXIDE NANOPARTICLES

#### 5.17.1 Properties

#### 5.17.2 Application in anti-microbial and anti-viral nanocoatings

### 5.18 ORGANIC NANOPARTICLES

#### 5.18.1 Types and properties

### 5.19 CHITOSAN NANOPARTICLES

#### 5.19.1 Properties

#### 5.19.2 Application in anti-microbial and anti-viral nanocoatings

##### 5.19.2.1 Wound dressings

##### 5.19.2.2 Packaging coatings and films

##### 5.19.2.3 Food storage

### 5.20 TWO-DIMENSIONAL (2D) MATERIALS

#### 5.20.1 Black phosphorus (BP)

#### 5.20.2 Layered double hydroxides (LDHs)

#### 5.20.3 Transition metal dichalcogenides (TMDs)

#### 5.20.4 Graphitic carbon nitride (g-C<sub>3</sub>N<sub>4</sub>)

#### 5.20.5 MXENE

### 5.21 HYDROPHOBIC AND HYDROPHILIC COATINGS AND SURFACES

#### 5.21.1 Hydrophilic coatings

#### 5.21.2 Hydrophobic coatings

##### 5.21.2.1 Properties

##### 5.21.2.2 Application in facemasks

### 5.22 SUPERHYDROPHOBIC COATINGS AND SURFACES

#### 5.22.1 Properties

##### 5.22.1.1 Anti-microbial use

##### 5.22.1.2 Durability issues

##### 5.22.1.3 Nanocellulose

### 5.23 OLEOPHOBIC AND OMNIPHOBIC COATINGS AND SURFACES

#### 5.23.1 SLIPS

#### 5.23.2 Covalent bonding

#### 5.23.3 Step-growth graft polymerization

#### 5.23.4 Applications

## 6 ANTI-MICROBIAL AND ANTI-VIRAL NANOCOATINGS MARKET STRUCTURE

## 7 MARKET ANALYSIS FOR ANTIMICROBIAL, ANTIVIRAL AND ANTIFUNGAL NANOCOATINGS

## 7.1 ANTI-MICROBIAL, ANTI-VIRAL AND ANTI-FUNGAL NANOCOATINGS

7.1.1 Market drivers and trends

7.1.2 Applications

7.1.3 Global revenues 2010-2032

7.1.4 Companies

## 7.2 ANTI-FOULING AND EASY-TO-CLEAN NANOCOATINGS

7.2.1 Market drivers and trends

7.2.2 Benefits of anti-fouling and easy-to-clean nanocoatings

7.2.3 Applications

7.2.4 Global revenues 2010-2032

7.2.5 Companies

## 7.3 SELF-CLEANING NANOCOATINGS

7.3.1 Market drivers and trends

7.3.2 Benefits of self-cleaning nanocoatings

7.3.3 Global revenues 2010-2032

7.3.4 Companies

## 7.4 PHOTOCATALYTIC COATINGS

7.4.1 Market drivers and trends

7.4.2 Benefits of photocatalytic self-cleaning nanocoatings

7.4.3 Applications

7.4.3.1 Self-Cleaning Coatings

7.4.3.2 Indoor Air Pollution and Sick Building Syndrome

7.4.3.3 Outdoor Air Pollution

7.4.3.4 Water Treatment

7.4.4 Global revenues 2010-2032

7.4.5 Companies

## 8 MARKET SEGMENT ANALYSIS, BY END USER MARKET

### 8.1 BUILDINGS AND CONSTRUCTION

8.1.1 Market drivers and trends

8.1.2 Applications

8.1.2.1 Protective coatings for glass, concrete and other construction materials

8.1.2.2 Photocatalytic nano-TiO<sub>2</sub> coatings

8.1.2.3 Global revenues 2010-2032

8.1.3 Companies

### 8.2 INTERIOR COATINGS, SANITARY AND INDOOR AIR QUALITY

8.2.1 Market drivers and trends

## 8.2.2 Applications

### 8.2.2.1 Self-cleaning and easy-to-clean

### 8.2.2.2 Food preparation and processing

### 8.2.2.3 Indoor pollutants and air quality

## 8.2.3 Global revenues 2010-2032

## 8.2.4 Companies

# 8.3 MEDICAL & HEALTHCARE

## 8.3.1 Market drivers and trends

## 8.3.2 Applications

### 8.3.2.1 Anti-fouling, anti-microbial and anti-viral medical device and equipment coatings

### 8.3.2.2 Medical textiles

### 8.3.2.3 Wound dressings and plastic catheters

### 8.3.2.4 Medical implant coatings

## 8.3.3 Global revenues 2010-2032

## 8.3.4 Companies

# 8.4 TEXTILES AND APPAREL

## 8.4.1 Market drivers and trends

## 8.4.2 Applications

### 8.4.2.1 PPE

## 8.4.3 Global revenues 2010-2032

## 8.4.4 Companies

# 8.5 PACKAGING

## 8.5.1 Market drivers and trends

## 8.5.2 Applications

### 8.5.2.1 Antimicrobial coatings and films in food packaging

## 8.5.3 Companies

# **9 ANTIMICROBIAL, ANTIVIRAL AND ANTIFUNGAL NANOCOATINGS COMPANIES 209 (157 COMPANY PROFILES)**

# **10 RECENT RESEARCH IN ACADEMIA**

# **11 REFERENCES**

## List Of Tables

### LIST OF TABLES

Table 1: Categorization of nanomaterials.

Table 2: Properties of nanocoatings.

Table 3. Market drivers and trends in antiviral and antimicrobial nanocoatings.

Table 4. Market and technical challenges for antimicrobial, anti-viral and anti-fungal nanocoatings.

Table 5. Toxicity and environmental considerations for anti-viral coatings.

Table 6: Technology for synthesizing nanocoatings agents.

Table 7: Film coatings techniques.

Table 8: Nanomaterials used in nanocoatings and applications.

Table 9. Graphene properties relevant to application in coatings.

Table 10. Bactericidal characters of graphene-based materials.

Table 11. Markets and applications for antimicrobial and antiviral nanocoatings graphene nanocoatings.

Table 12. Commercial activity in antimicrobial and antiviral graphene nanocoatings.

Table 13. Markets and applications for antimicrobial nanosilver nanocoatings.

Table 14. Antimicrobial effect of silver nanoparticles (AgNP) incorporated into food packaging.

Table 15. Companies developing antimicrobial silver nanocoatings.

Table 16. Antibacterial effects of ZnO NPs in different bacterial species.

Table 17. Types of carbon-based nanoparticles as antimicrobial agent, their mechanisms of action and characteristics.

Table 18. Companies developing antimicrobial copper nanocoatings.

Table 19. Types of organic nanoparticles and application in antimicrobials.

Table 20. Mechanism of chitosan antimicrobial action.

Table 21: Contact angles of hydrophilic, super hydrophilic, hydrophobic and superhydrophobic surfaces.

Table 22: Disadvantages of commonly utilized superhydrophobic coating methods.

Table 23: Applications of oleophobic & omniphobic coatings.

Table 24: Antimicrobial and antiviral Nanocoatings market structure.

Table 25: Anti-microbial, anti-viral and anti-fungal nanocoatings-Nanomaterials used, principles, properties and applications

Table 26. Nanomaterials utilized in antimicrobial and antiviral nanocoatings coatings-benefits and applications.

Table 27: Antimicrobial and antiviral nanocoatings markets and applications.

Table 28: Market assessment of antimicrobial and antiviral nanocoatings.

Table 29: Opportunity for antimicrobial and antiviral nanocoatings.

Table 30: Historical revenues for antimicrobial and antiviral nanocoatings, 2010-2021, US\$.

Table 31: Revenues for antimicrobial and antiviral nanocoatings, 2022-2032, US\$ (low, medium and high growth estimates).

Table 32: Antimicrobial and antiviral nanocoatings product and application developers.

Table 33: Anti-fouling and easy-to-clean nanocoatings-Nanomaterials used, principles, properties and applications.

Table 34: Market drivers and trends in Anti-fouling and easy-to-clean nanocoatings.

Table 35: Anti-fouling and easy-to-clean nanocoatings markets, applications and potential addressable market.

Table 36: Market assessment for anti-fouling and easy-to-clean nanocoatings.

Table 37: Historical revenues for anti-fouling and easy-to-clean nanocoatings, 2010-2032, US\$.

Table 38: Revenues for antifouling and easy-to-clean nanocoatings, 2022-2032, US\$ (low, medium and high growth estimates).

Table 39: Anti-fouling and easy-to-clean nanocoatings product and application developers.

Table 40: Self-cleaning nanocoatings-Nanomaterials used, principles, properties and applications.

Table 41: Market drivers and trends in Self-cleaning (bionic) nanocoatings.

Table 42: Self-cleaning (bionic) nanocoatings-Markets and applications.

Table 43: Market assessment for self-cleaning (bionic) nanocoatings.

Table 44: Historical revenues for self-cleaning nanocoatings, 2010-2032, US\$.

Table 45: Revenues for self-cleaning nanocoatings, 2022-2032, US\$ (low, medium and high growth estimates).

Table 46: Self-cleaning (bionic) nanocoatings product and application developers.

Table 47: Photocatalytic coatings-Nanomaterials used, principles, properties and applications.

Table 48: Market drivers and trends in photocatalytic nanocoatings.

Table 49: Photocatalytic nanocoatings-Markets, applications and potential addressable market size by 2032.

Table 50: Market assessment for self-cleaning (photocatalytic) nanocoatings.

Table 51: Historical revenues for Self-cleaning (photocatalytic) nanocoatings, 2010-2032, US\$.

Table 52: Revenues for Self-cleaning (photocatalytic) nanocoatings, 2022-2032, US\$ (low, medium and high growth estimates).

Table 53: Self-cleaning (photocatalytic) nanocoatings product and application developers.

- Table 54: Market drivers and trends for antimicrobial, antiviral and antifungal nanocoatings in the buildings and construction market.
- Table 55: Nanocoatings applied in the building and construction industry-type of coating, nanomaterials utilized and benefits.
- Table 56: Photocatalytic nanocoatings-Markets and applications.
- Table 57: Revenues for nanocoatings in construction, architecture and exterior protection, 2010-2032, US\$.
- Table 58: Construction, architecture and exterior protection nanocoatings product developers.
- Table 59: Market drivers and trends for antimicrobial, antiviral and antifungal nanocoatings in Interior coatings, sanitary, and indoor air quality.
- Table 60: Revenues for nanocoatings in Interior coatings, sanitary, and indoor air quality, 2010-2032, US\$.
- Table 61: Interior coatings, sanitary, and indoor air quality nanocoatings product developers.
- Table 62: Market drivers and trends for antimicrobial, antiviral and antifungal nanocoatings in medicine and healthcare.
- Table 63: Nanocoatings applied in the medical industry-type of coating, nanomaterials utilized, benefits and applications.
- Table 64: Antibacterial nanomaterials used in wound healing .
- Table 65: Types of advanced coatings applied in medical devices and implants.
- Table 66: Nanomaterials utilized in medical implants.
- Table 67: Revenues for nanocoatings in medical and healthcare, 2010-2032, US\$.
- Table 68: Medical and healthcare nanocoatings product developers.
- Table 69: Market drivers and trends for antimicrobial, antiviral and antifungal nanocoatings s in the textiles and apparel industry.
- Table 70: Applications in textiles, by advanced materials type and benefits thereof.
- Table 71: Nanocoatings applied in the textiles industry-type of coating, nanomaterials utilized, benefits and applications.
- Table 72: Revenues for nanocoatings in textiles and apparel, 2010-2032, US\$.
- Table 73: Textiles nanocoatings product developers.
- Table 74: Market drivers and trends for nanocoatings in the packaging market.
- Table 75: Revenues for nanocoatings in packaging, 2010-2032, US\$.
- Table 76: Food packaging nanocoatings product developers.
- Table 77: Photocatalytic coating schematic.
- Table 78: Antimicrobial, antiviral and antifungal nanocoatings development in academia.

## List Of Figures

### LIST OF FIGURES

Figure 1. Schematic of anti-viral coating using nano-actives for inactivation of any adhered virus on the surfaces.

Figure 2. Face masks coated with antibacterial & antiviral nanocoating.

Figure 3: Hydrophobic fluoropolymer nanocoatings on electronic circuit boards.

Figure 4: Nanocoatings synthesis techniques.

Figure 5: Techniques for constructing superhydrophobic coatings on substrates.

Figure 6: Electrospray deposition.

Figure 7. CVD technique.

Figure 8. Schematic of ALD.

Figure 9. A substrate undergoing layer-by-layer (LbL) nanocoating.

Figure 10. SEM images of different layers of TiO<sub>2</sub> nanoparticles in steel surface.

Figure 11. The coating system is applied to the surface. The solvent evaporates.

Figure 12. A first organization takes place where the silicon-containing bonding component (blue dots in figure 2) bonds covalently with the surface and cross-links with neighbouring molecules to form a strong three-dimensional.

Figure 13. During the curing, the compounds organise themselves in a nanoscale monolayer. The fluorine-containing repellent component (red dots in figure) on top makes the glass hydro- phobic and oleophobic.

Figure 14: Antimicrobial activity of Graphene oxide (GO).

Figure 15: Hydrophobic easy-to-clean coating.

Figure 16 Anti-bacterial mechanism of silver nanoparticle coating.

Figure 17: Mechanism of photocatalysis on a surface treated with TiO<sub>2</sub> nanoparticles.

Figure 18: Schematic showing the self-cleaning phenomena on superhydrophilic surface.

Figure 19: Titanium dioxide-coated glass (left) and ordinary glass (right).

Figure 20: Self-Cleaning mechanism utilizing photooxidation.

Figure 21: Schematic of photocatalytic air purifying pavement.

Figure 22: Schematic of photocatalytic indoor air purification filter.

Figure 23: Schematic of photocatalytic water purification.

Figure 24. Schematic of antibacterial activity of ZnO NPs.

Figure 25: Types of nanocellulose.

Figure 26. Mechanism of antimicrobial activity of carbon nanotubes.

Figure 27: Fullerene schematic.

Figure 28. TEM images of Burkholderia seminalis treated with (a, c) buffer (control) and (b, d) 2.0 mg/mL chitosan; (A: additional layer; B: membrane damage).



Figure 29: Structure of 2D molybdenum disulfide.

Figure 30: Graphitic carbon nitride.

Figure 31: (a) Water drops on a lotus leaf.

Figure 32: A schematic of (a) water droplet on normal hydrophobic surface with contact angle greater than  $90^\circ$  and (b) water droplet on a superhydrophobic surface with a contact angle  $> 150^\circ$ .

Figure 33: Contact angle on superhydrophobic coated surface.

Figure 34: Self-cleaning nanocellulose dishware.

Figure 35: SLIPS repellent coatings.

Figure 36: Omniphobic coatings.

Figure 37: Schematic of typical commercialization route for nanocoatings producer.

Figure 38: Market drivers and trends in antimicrobial and antiviral nanocoatings.

Figure 39. Nano-coated self-cleaning touchscreen.

Figure 40. Historical revenues for antimicrobial and antiviral nanocoatings, 2010-2021, US\$.

Figure 41: Revenues for antimicrobial and antiviral nanocoatings, 2022-2032, US\$ (low, medium and high growth estimates).

Figure 42: Anti-fouling treatment for heat-exchangers.

Figure 43: Markets for anti-fouling and easy clean nanocoatings, by %, 2021.

Figure 44: Potential addressable market for anti-fouling and easy-to-clean nanocoatings by 2031.

Figure 45. Historical revenues for anti-fouling and easy-to-clean nanocoatings, 2010-2032, US\$.

Figure 46: Revenues for antifouling and easy-to-clean nanocoatings, 2022-2032, US\$ (low, medium and high growth estimates).

Figure 47: Self-cleaning superhydrophobic coating schematic.

Figure 48: Markets for self-cleaning nanocoatings, %, 2021

Figure 49: Potential addressable market for self-cleaning (bionic) nanocoatings by 2032.

Figure 50. Historical revenues for self-cleaning nanocoatings, 2010-2032, US\$.

Figure 51: Revenues for self-cleaning nanocoatings, 2022-2032, US\$ (low, medium and high growth estimates).

Figure 52: Principle of superhydrophilicity.

Figure 53: Schematic of photocatalytic air purifying pavement.

Figure 54: Tokyo Station GranRoof. The titanium dioxide coating ensures long-lasting whiteness.

Figure 55: Markets for self-cleaning (photocatalytic) nanocoatings 2021, %.

Figure 56: Potential addressable market for self-cleaning (photocatalytic) nanocoatings by 2032.

Figure 57. Historical revenues for Self-cleaning (photocatalytic) nanocoatings,



2010-2032, US\$.

Figure 58: Revenues for Self-cleaning (photocatalytic) nanocoatings, 2022-2032, US\$ (low, medium and high growth estimates).

Figure 59: Nanocoatings in construction, architecture and exterior protection, by coatings type %, 2020.

Figure 60: Potential addressable market for nanocoatings in the construction, architecture and exterior coatings sector by 2031.

Figure 61: Revenues for nanocoatings in construction, architecture and exterior protection, 2010-2032, US\$.

Figure 62: Nanocoatings in Interior coatings, sanitary, and indoor air quality, by coatings type %, 2020.

Figure 63: Potential addressable market for nanocoatings in Interior coatings, sanitary, and indoor air quality by 2032.

Figure 64: Revenues for nanocoatings in Interior coatings, sanitary, and indoor air quality, 2010-2032, US\$.

Figure 65: Anti-bacterial sol-gel nanoparticle silver coating.

Figure 66: Nanocoatings in medical and healthcare, by coatings type %, 2020.

Figure 67: Potential addressable market for nanocoatings in medical & healthcare by 2031.

Figure 68: Revenues for nanocoatings in medical and healthcare, 2010-2032, US\$.

Figure 69: Omniphobic-coated fabric.

Figure 70: Nanocoatings in textiles and apparel, by coatings type %, 2020.

Figure 71: Potential addressable market for nanocoatings in textiles and apparel by 2031.

Figure 72: Revenues for nanocoatings in textiles and apparel, 2010-2032, US\$.

Figure 73: Oso fresh food packaging incorporating antimicrobial silver.

Figure 74: Revenues for nanocoatings in packaging, 2010-2032, US\$.

Figure 75. Lab tests on DSP coatings.

Figure 76. Laser-functionalized glass.

Figure 77. GrapheneCA anti-bacterial and anti-viral coating.

Figure 78. Microlyte® Matrix bandage for surgical wounds.

Figure 79. Self-cleaning nanocoating applied to face masks.

Figure 80. NanoSeptic surfaces.

Figure 81. Nasc NanoTechnology personnel shown applying MEDICOAT to airport luggage carts.

Figure 82. V-CAT® photocatalyst mechanism.

Figure 83. Applications of Titanystar.

## I would like to order

Product name: The Global Market for Antimicrobial, Antiviral and Antifungal Nanocoatings 2022-2032

Product link: <https://marketpublishers.com/r/GB4AF83B20CAEN.html>

Price: US\$ 1,100.00 (Single User License / Electronic Delivery)

If you want to order Corporate License or Hard Copy, please, contact our Customer Service:

[info@marketpublishers.com](mailto:info@marketpublishers.com)

## Payment

To pay by Credit Card (Visa, MasterCard, American Express, PayPal), please, click button on product page <https://marketpublishers.com/r/GB4AF83B20CAEN.html>

To pay by Wire Transfer, please, fill in your contact details in the form below:

First name:  
Last name:  
Email:  
Company:  
Address:  
City:  
Zip code:  
Country:  
Tel:  
Fax:  
Your message:

**\*\*All fields are required**

Customer signature \_\_\_\_\_

Please, note that by ordering from marketpublishers.com you are agreeing to our Terms & Conditions at <https://marketpublishers.com/docs/terms.html>

To place an order via fax simply print this form, fill in the information below and fax the completed form to +44 20 7900 3970