Major findings

Challenges and opportunities in the surface engineering industry

- **Competitive market conditions**: The German surface engineering industry is dominated by about 3,000 SMEs. Approximately 86% of all German surface engineering companies have less than 100 employees. Reasons for the fragmented market are the variety of technological methods and the manifold fields of applications.

- **Innovative market environment**: Plasma and nanotechnology as cross-methodical improvements enable new applications and increase efficiency. Especially the coating sector is affected by this trend. Coatings are no longer only protective, functional or decorative; they become multifunctional and smart by responding dynamically to changes in the environment of the surface.

- **Legal regulation**: Chromium trioxide is widely debated regarding the restrictions of REACH. Companies have to apply for authorization of Substances of Very High Concern (SVHC) or look for alternative substances.

- **Environmental protection**: Legislators and customers establish requirements of sustainability and environmental compatibility of products, so water-based coatings and powder coatings become more likely. Germany, a pioneer in environmental protection and sustainability, is highly affected by this trend.

The surface engineering market at a glance

- The global paints and coatings market, worth USD 141.5bn in 2015, is expected to be worth USD 164.1bn by 2021.

- The growth shows regional and technological differences: The APAC region is expected to grow at a CAGR of 6.5% compared to a CAGR of 2.0% in Europe. From a technological point of view, sustainable technologies, nanotechnology and smart coatings are expected to grow stronger than traditional ones.

- The M&A market for paints and coatings remains active with about 30-35 transactions per year. Especially PEs become interested in strong growing niche markets.

- In the years 2015 and 2016, the mean EBITDA multiple for transactions in the surface engineering industry was 10.25x.

- Transaction rationales were mostly consolidation.

Sources: Clairfield International research, PCI, MarketLine, Statista, Mergermarket
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Market analysis
Market analysis overview

Surface engineering as a cross-sector industry

- Surface engineering is a process, designed to modify a product’s surface
- Surfaces of prefabricated products are treated or coated before assembly and delivery
- The surface engineering industry is highly specified due to different characteristics of materials and different applications of products
- As a result, there are many different technologies available to meet customer needs from key industries such as automotive, aerospace, medical, semiconductor and energy

Value added of surface engineering

- **Protection** against
  - Corrosion
  - Wear
  - Friction
- Establish **functionality**
  - Isolation or electrical conductivity
  - Hydrophobicity or hydrophilicity
  - Compatibility (e.g. body implants)
- Enhance functionality or **efficiency**
  - Fuel saving
  - Appearance
  - Reduction of environmental pollution

Focus of market analysis

- Market characteristics and expectations
- Technological diversity and technological advance
- Environmental protection
- Meeting customer’s demand

Source: Clairfield International research, TZO, WWF
Surface engineering: Many technologies and fields of application lead to different characteristics and expectations

**Characteristics of the surface engineering industry**

- **Economic importance**: Without surface optimization, product durability is drastically shortened and many products would not even be marketable
- **Industry is split in two**: Due to different products and tasks, there are many methods of surface engineering. The methods can be categorized in surface treatment and surface coating
  - Surface treatment is the procedure to change the texture or density of the surface
  - Surface coating is the process of applying a cover to the surface
- **Manifold sector with various niches**: Due to manifold customer segments, there are several different methods and fields of application. This leads to a diverse business sector with specialized companies
  - Concentrating on one niche market limits the size of companies and shows a growth barrier
  - Hence, the surface engineering industry is characterized by many small and medium-sized enterprises (SME)
- **Fast-moving field**: Especially the coating segment is subject to fast technical changes and improvements as a consequence of the increasing demand for specialized coatings and new environmental regulations
- **R&D cooperation**: Due to their limited capacity, SMEs are cooperating with research facilities. Large companies often incorporate their own R&D department, but also use the expertise of research institutes like Fraunhofer. This leads to an innovative sector with intensive interrelation of research institutions, universities and companies
- **Integration of surface engineering into the manufacturing**: There is a trend towards integrating surface treatment into linear manufacturing systems, but this is reserved for mainly large companies

**Region and segment analysis**

**Overall growth expectations**

- The global paints and coatings market as a part of the surface engineering market, worth USD 141.5bn in 2015, is expected to be worth USD 164.1bn by 2021
- The global metal finishing market was worth USD 64.2bn in 2014. The market is expected to grow at a CAGR of 6.5% until 2020, driven by increasing demand from industries as automotive, aerospace and electronics

**Region analysis**

- The Asia-Pacific region is expected to grow at a CAGR of 6.5% until 2020, representing the major market for paints, coatings and metal finishing. Asia-Pacific accounted for more than 40% of the market demand by value of the total global demand in 2015
- The market is further expected to grow due to setup of automotive and electronic industries in countries as China and India
- The surface engineering market in Europe is expected to grow at a CAGR of 2.0% until 2020 and remains the second largest market with a market share of approximately 23%

**Segment analysis**

- The architectural and decorative segment accounts for 51.5% of the total value of the paints and coatings market
- The automotive segment accounts for USD 21.5bn, equaling 15% of the total value

Source: Clairfield International research, PCI, MarketLine
The German surface engineering sector is dominated by SMEs. Approximately 86% of all German surface engineering companies have less than 100 employees.

In Germany, about 3,000 companies offer services in surface engineering. This implies, that there is a high degree of specialization regarding the applied technology and customer landscape in Germany.

Considering companies with more than 20 employees, the surface engineering market in Germany was worth about EUR 7.5bn in 2015.

The surface engineering sector in Germany is expected to be worth EUR 12.6bn by 2020.

Customers of the automotive sector contribute about 40% to the total revenues in the surface engineering market.

Export contributes 15% of revenues.

According to the German Renewable Energy Act, the shift to renewable energy is financed by a premium on the energy price. Companies with energy-intensive production are exempt from paying the premium. Surface engineering companies are not included in this exception and small-sized company struggle with extra costs, although the business is very energy intensive.

The trend of Industry 4.0 influences the surface engineering industry. The test and measurement of surfaces regarding corrosion detection, coating thickness and roughness are key processes to enable automated production processes.

As the automotive sector is important for companies operating in the surface engineering sector, the proximity to OEMs and tier 1 suppliers is important to save costs in transportation.

The number of companies with at least 50 employees is constantly increasing. This implies, that there is a trend to consolidation.

Source: Clairfield International research, Statista, ZVO, JOT
German market players and their strategy

BENSELER Holding GmbH + Co. KG

www.benseler.de

- Benseler operates in the fields of coatings, thin-film corrosion protection and deburring. They operate mainly in the automotive sector
- Methods and technologies used: Waterborne coating, powder coating, PVD, deburring
- Revenue: about EUR 130mn (2015)
- Employees: about 950 (2015)
- Latest news: Acquisition of BV Oberflächentechnik GmbH & Co. KG and a 70% stake in Prove Tech CZ s.r.o. (both 2015)

Mankiewicz Gebr. & Co. (GmbH & Co. KG)

www.mankiewicz.com

- Mankiewicz provides coating systems for the general Industry, aviation and automotive markets worldwide
- Methods and technologies used: Waterborne coatings
- Employees: 1248 (2015)
- Latest news: Mankiewicz announced expansion of US operations due to high demand (Oct. 2016)

Atotech Deutschland GmbH

www.atotech.com

- Atotech provides plating chemicals for the printed circuit board, chip carrier and semiconductor industry as well as decorative and functional surface finishing
- Methods and technologies used: Plating in many various forms, e.g. zink, gold, copper and nickel
- Employees: 1015 (2015)
- Latest news: Atotech was sold to the Carlyle Group (Oct. 2016)

Strategies of market leaders in common

- M&A activity
  - Gain customer access and distribution networks in new markets
  - Incorporate new technologies to enable synergies regarding customer demand
- Several locations in close proximity to customer, e.g. automotive suppliers, to reduce costs in transportation
- Use of traditional and established technologies, which address multiple customer segments

Source: Clairfield International research
The surface engineering industry is split in two main types of technologies: Surface treatment and surface coating

### Overview and description of selected technologies

**Surface treatment technologies**
- **Mechanical finishing** is often used as a pre-treatment of the product, to ensure effectiveness of further procedure. Processes like grinding, polishing, peening, blasting and deburring are used
- **Thermal treatment** is the alternating use of heat and cold to change the properties, like hardness, of metal surfaces. This method includes processes like flame hardening, laser treatment and electron beam treatment
- **Diffusion hardening** is a process designed to increase the hardness of steel by exposing the surface to elements which diffuse into the surface. Typical processes are carburizing, aluminizing, nitriding and boriding
- **Ion implantation** aims to modify the surface regarding electrical conductivity properties and is often used in the semiconductor industry. This method includes nitrogen and carbon implantation

**Surface coating technologies**
- **Chemical** processes add thin films of sulphide or oxide by chemical reactions. The method is used for metal colouring, corrosion protection and priming
- **Plating** is a process to cover a surface with a metallic layer, e.g. gold, zinc and copper to increase corrosion and wear protection, reduce friction or for decorative use
- **Physical vapour deposition (PVD)** adds a thin layer to the surface. Therefore, the coating is first transferred into vapour state by physical processes and secondly condensed on the surface
- **Chemical vapour deposition (CVD)** involves the formation of a thin solid film on a surface by a chemical reaction within a vacuum. The surface is exposed to the coating in gaseous state and is often used in the semiconductor industry
- **Thermal spraying** is a method to add a melted or heated coating to a surface without heating the surface itself. Typical coatings include metals, ceramics and plastics

### Choosing the adequate method: extract of decision criteria

Depending on the task to accomplish, e.g. decorative appearance, protection against corrosion or hardening, every method shows its specific solution portfolio

The environmental sustainability has to be ensured regarding the application of the coated product to be in line with legal regulation

Regarding coating methods, the thickness of an layer is crucial. For instance, coated parts have to fit exactly for further assembly

The type of substrate treated or coated plays an important role regarding the needed temperature of the method. Plastic or aluminum have to be treated differently than metal, in order to maintain their shape

Cost intensity and energy consumption are important criteria, as many methods offer the same solution portfolio
In general, surface treatment processes can be regarded as less innovative than surface coating methods. As a consequence, there is a less diverse market in the surface treatment business field compared to the coating sector.

- Scientific research is focused on coating techniques because there is a higher need for research than for example in thermal treatment or in finishing.
- The high rate of innovation within the coating segment enables a broader field of application and continuing exploration of new applications.

- Especially simple surface treatment processes, such as polishing and grinding, add little value to products. In contrast to that, coatings improve the characteristics of products strongly and increase the products' value and establish their applicability.
- Thus, the following focus will be on coating techniques and their applications.

To get a better feeling for the coating thicknesses: A human hair can be 17 to 181 µm thick depending on the hair structure of the person (Ley, 1999). The following image shows a nanowire (approx. 1 µm thick) in front of a human hair.
The market for smart coatings is expected to grow from USD 953mn in 2016 to USD 10.7bn in 2022. This growth will arise at the cost of traditional coatings as they do not offer multifunctional, switchable and automated characteristics. Companies have to anticipate this trend and should invest in R&D to balance possible declines in sales.

- Actually, revenues in the field of smart coatings are driven by very specialized applications, like antimicrobial coatings for surgical tools, anti icing and anti corrosion. The fields of applications will spread widely in the next couple of years.

- Surface treatment cannot provide the advantages of multifunctionality and adaptation to the environment.
Selected coating methods in detail (1/2)

**Thermal spray**

- Thermal spraying is based on the melting of a metal wire or powder. The melted metal is afterwards atomized by a compressed gas that spreads the metal droplets on the substrate
  - Combustion coating utilizes combustible gasses to create the energy necessary to melt the coating material
  - The electrical methods allow spraying metals with higher melting points such as steel, zinc and stainless steel onto the surface
  - The cold spraying technique operates at lower temperatures than the combustion and electrical methods. The relatively low temperatures help to minimize the altering of the substrate’s microstructure
- In general, the deposit does not fuse with the substrate or form a solid solution. The bond is primarily mechanical
- The coating thickness ranges from 20 micrometers to several mm, depending on the process and material to be applied

**Anodizing**

- Anodizing is an electro-chemical process to transform the surface of aluminium to aluminium oxide. The resulting oxide layer is permanently connected with the aluminium
- During the process, the aluminium object is immersed into a electrolytic solution and a direct current is passed through the solution, with the object as the anode. Hydrogen is released at the cathode and aluminium-oxide is created on the aluminium surface
- The anodized aluminium layer protects the object against tribological and chemical impacts. Anodizing also prevents the material from corrosion and wear, and ensures a better adhesion for paint primers and glues
- Layers for corrosion protection are usually between 5-25 µm thick, but depending on the application, they can reach layer thickness up to 500 µm (e.g. for decorative coatings)
Selected coating methods in detail (2/2)

Chemical vapour deposition (CVD)

- Chemical vapour deposition (CVD) is a process in order to deposit a thin solid film on a substrate material, by a chemical reaction.
- During the CVD process, precursors in carrier gases react with the surface of the substrate by getting in contact with each other:
  - The precursor will be separated and added to the surface of the substrate.
- The chemical reactions can be initiated by heat or higher frequency radiation such as UV or plasma:
  - This leads to the three major CVD types: Thermal CVD, photo-assisted CVD and plasma-enhanced CVD.
- Chemical vapour deposition processes usually run at 600-1100°C. However, the use of plasma in the CVD process makes it possible to lower the operating temperature to 200-500°C since electrical energy rather than thermal energy is used to initiate homogeneous reactions.

Physical vapour deposition (PVD)

- Physical vapor deposition (PVD) physically removes material from a source by evaporation or sputtering. Afterwards, the removed material is transported through a vacuum by the energy of the vapor particles and condenses as a film on the surfaces of the substrate.
- PVD is a line-of-sight process and thus requires the substrate surface to be easily accessible.
- The typical process temperature for PVD is between 250 and 600°C.
- There are three main types of PVD:
  1. Thermal evaporation
     - Material is heated to a gas phase, where it then spreads through the vacuum to the substrate.
  2. Sputtering
     - The material is bombarded by a glow plasma discharge and thus transferred into the gas phase.
  3. Ion plating
     - A combination of thermal evaporation and sputtering.

Source: Clairfield International research, University Erlangen-Nürnberg
Plasma – a cross-methodical improvement

Methodical improvement through the use of plasma

- The use of plasma within the surface engineering industry is a key cross-methodical technological improvement. Applications of plasma within the surface engineering industry range from the simple cleaning of surfaces to surface coating techniques.
- To generate plasma, additional energy is added to gases. As a result, the gases become ionized and reach the plasma state.
- When the plasma comes into contact with the material’s surface, it changes the surface’s characteristics to enable reactions right on the surface of the substrate. Hence, the plasma acts as an energy source.
- In general, plasma surface treatment is a process that raises the surface’s energy of materials, in order to improve the bonding characteristics.
- The coating materials themselves do not enter the plasma state. There are different methods available, on how the coating materials get in contact with the plasma.
- Examples of plasma coating methods are:
  - Plasma spray as a form of thermal spray
  - Plasma-enhanced chemical vapour deposition as a form of CVD
  - Sputtering as a form of PVD

- Plasma enables the partial replacement of energy-intensive surface engineering methods which helps to lower the overall surface processing costs, especially regarding the increasing energy costs due to the German Renewable Energy Act. In addition to that, it increases the ecological friendliness of processes.
- The use of plasma-based methods makes it possible, to perform the process at lower temperatures. Consequently, sensitive materials can be treated with methods that would otherwise destroy the substrate.

Market development of plasma surface engineering methods

- Plasma surface technology has developed rapidly regarding equipment, operations and process technology in order to meet the increasing demand.
- European SMEs operating in this sector persist in global competition due to their innovative strength and their know-how in the sector of plasma-based surface technologies.
  - Europe acts as a trendsetter in the global plasma surface sector.
- The plasma surface sector was able to record double-digit growth rates in the past. The growth rates are positively influenced by the expansion of applications to new markets and the increasing penetration of established markets.
- Regulations concerning environmental aspects have supported the development of plasma surface technologies.
Clairfield International at a glance
Clairfield International is well prepared for cross-border transactions thanks to 35 offices in 23 countries

Clairfield worldwide

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Worldwide small cap ranking 2016

- 480+ Professionals across 35 country offices
- 114 M&A transactions closed in 2016 (small and medium cap)
- EUR 2.8bn Cumulative value of transactions closed in 2016

Europe
- Austria Vienna
- Belgium Antwerp Brussels
- Denmark Copenhagen
- Finland Helsinki
- France Lyon Paris Marseille Nantes
- Germany Stuttgart Frankfurt Düsseldorf
- Hungary Budapest
- Israel Tel Aviv
- Italy Milan
- Netherlands Amsterdam
- Norway Oslo

Americas
- Brasil Curitiba Sao Paulo
- Chile Santiago de Chile
- Mexico Mexico City
- USA Miami New York Washington D.C.

Asia-Pacific
- Australia Brisbane
- China Hong Kong
Traction in all relevant European markets with strong M&A team in Germany

**Clairfield in Europe**

- **26 offices**  
  With 26 offices strong presence in Europe
- **17 countries**  
  Active in all relevant European markets
- **#11**  
  Top 15 in Europe

**European small cap ranking 2016**

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**Clairfield in Germany**

- **Senior partners**
  - Dirk Freiland  
    - 20 years M&A  
    - TMT, automotive & machinery, services
  - Jack Helm  
    - 30 years  
    - Health care, industry, automatization
  - Darius Kianzad  
    - 20 years  
    - Clean tech, health care, resources
  - Dr. Hanns-Alexander Klemm  
    - 30 years  
    - Industry, healthcare, retail
  - Martin Lemmer  
    - 13 years  
    - Food and beverage, business services
  - Dirk Middelhoff  
    - 10 years  
    - TMT, high-tech
  - Andreas Piechotta  
    - 16 years  
    - Industry, medical technology
  - Dr. Albert Schander  
    - 22 years  
    - Consumer goods, industry, logistic, retail
  - Peter Thomas  
    - 25 years  
    - Automotive, financials, consumer, retail

**Strong presence all over Germany, covering all major industries supported by:**
- approx. 20 junior and senior professionals across three offices
- more than 25 senior industrial experts
## Assisting clients in mid-sized, cross-border transactions

### Our services

| Mergers & Acquisitions | - Design, initiation and execution of international and domestic acquisition opportunities  
| | - Strategic partnerships and alliances  
| | - Strategic alternative reviews  
| | - Search for strategic and financial investors  
| Disposals/Divestitures | - Feasibility analysis  
| | - Divestitures, spin-offs and carve outs  
| | - Valuations and fairness opinions  
| Capital solutions | - Financial sponsor transactions (MBO and LBO)  
| | - Debt advisory: advisory in acquisition finance, debt financing, recaps  
| | - Equity advisory: independent advisory in IPOs, rights issues and placings  
| | - Strategic investor relations advisory  
| Advisory | - Strategic advisory services, such as valuations and fairness opinions, market entry feasibility  
| | - Advisory on strategic alliances, mergers, licensing and joint ventures  
| | - Market studies  
| | - Monitoring trustee  
| Restructuring advisory | - Restructuring and recovery  
| | - Special situations  

### Our focus

| Mid-Market | Clairfield is one of the leading global M&A firms typically executing mid-sized transactions up to an enterprise value of 500 m€  
| Cross-border | With partner offices in 50% of all OECD countries, Clairfield International covers 75% of Germany’s most significant trade partners  
| Long-term relationships | Our advice is embedded in long term relationships with corporates, family offices and private equity investors  

### Our philosophy

| Sector expertise | The longstanding experiences of our partners in diverse industries in combination with outstandingly connected industry experts are enabling our clients to open up new strategic possibilities  
| Confidentiality | Trust and integrity are essential values for our advisory services. Information are treated with highest discretion  
| Seniority of the team | Senior involvement throughout all phases of a transaction is the single most important hallmark of our execution style and commitment to quality and prudent advice  
| Independence | We own our business and act as entrepreneurs free of conflicts usually found in large multi-product firms  

Strong sector expertise and understanding client industries

**Business Services**: Business Services, Distribution, Logistics, Industrial Services, Education, Staffing, Engineering

**Natural Resources, Cleantech & Energy**: Metals & Mining, Oil & Gas, Renewable Energy, Power, Coal & Fuels, Oilfield Services, Nuclear

**Consumer Goods, Food & Retail**: Consumer Goods, Retail, Real Estate, Furniture, Food & Beverage, Food Services, Agribusiness

**Financial Institutions & Private Equity**: Financial Services, e finance, Debt Collection, Asset Mgmt., Family offices, Insurance, Private Equity

**Healthcare & Life Sciences**: Medical Devices, Medical Supplies, Pharma & Biotech, Animal Health, Lab Services & Equipment, Hospitals & Clinics

**Industrials**: Automotive, Building Materials, Wood Processing, Test & Measuring, Machinery, Chemicals, Aerospace

**Technology, Media & Telecoms**: Digital & Traditional Media, IT Services, IT Consulting, Hardware, Software & Equipment

**Representative Clients**:
- Manpower
- Europcar
- RWE
- E.on
- E.ing
- Accent Jobs
- FM Logistic
- Energiekontor
- Douglas
- Coca-Cola
- P&G
- Total
- Shell
- HP
- Siemens
- ING
- HSBC
- ARDIAN
- Bavarian LB
- MetLife
- Fresenius
- Mankiewicz
- AHC
- Chemetall
- Collini
- AT&T
- Huawei
- IBM
- BT
- Xerox
### Selected transactions of Clairfield International in the surface engineering industry

<table>
<thead>
<tr>
<th>Location</th>
<th>Transaction Type</th>
<th>Company A</th>
<th>Company B</th>
<th>Advisor to the Seller</th>
<th>Advisor to the Buyer</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Czech Republic/France</td>
<td>Sale</td>
<td>GUMOTEX</td>
<td>Rubber-coating technology</td>
<td>Advisor to the seller</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Germany/USA</td>
<td>Buy</td>
<td>ECRONOMY</td>
<td>Water-based coatings</td>
<td>Advisor to the buyer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finland</td>
<td>Sale</td>
<td>KEMIRA</td>
<td>Surface treatment plants</td>
<td>Advisor to the seller</td>
<td></td>
<td>EUR 22,000,000 Colour materials for the ceramic industry</td>
</tr>
<tr>
<td>Italy</td>
<td>Debt restructuring</td>
<td>VETRICERAMICI</td>
<td></td>
<td>Advisor to Vetriceramic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>France</td>
<td>Sale</td>
<td>ITW</td>
<td>Sprayable gel-coatings</td>
<td>Advisor to the seller</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Italy</td>
<td>Buy</td>
<td>SAMIA</td>
<td>Leather treatment</td>
<td>Advisor to the buyer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Italy</td>
<td>Sale</td>
<td>ACT</td>
<td>Gel-coatings</td>
<td>Advisor to the seller</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Italy</td>
<td>Sale</td>
<td>FERRO</td>
<td>Ceramic coatings</td>
<td>Advisor to the seller</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
D.

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<table>
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<th>Phone</th>
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</thead>
<tbody>
<tr>
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  - Paris
  - Marseille
  - Nantes

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  - Budapest

- Clairfield Italy
  - Milan

- Clairfield Israel
  - Tel Aviv

- Clairfield Netherlands
  - Amsterdam

- Clairfield Norway
  - Oslo

- Clairfield Poland
  - Warsaw

- Clairfield Russia
  - Moscow

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  - Stockholm

- Clairfield Switzerland
  - Geneva

- Clairfield Spain
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  - Madrid
  - Valencia

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  - London

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- Clairfield Mexico
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  - New York
  - Washington D.C.

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  - Brisbane

- Clairfield China
  - Hong-Kong