



# When formulation makes the difference: cohesive hybrid powder

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**T**he growing customer competence and attention toward the functionality and texture of a cosmetic product force formulation chemists to satisfy customer demands by creating products which are not only efficient, but which also possess new sensory features

Compact, moulded and baked make-up are the three most popular categories, because they have peculiar features. Compact make-up is well-known for the following effects: flaking, glazing, dusting and cracking – and even with well-formulated compact make-up

(i.e. not characterized by the issues listed above), there still are the «talc powder dilemma», the easy breaking in case of a fall and the consequences of a very invasive action on the powder, such as pressing. Since most compact powders are made of approximately 40% of talc powder («talc powder dilemma»), it is easy to realize that sensory differentiation becomes extremely difficult, but, if we remove the talc powder, the pressing operation itself often becomes extremely difficult. It does not matter how scrupulous we are in running a drop test on the pressed product: the smaller quantity in the cachet, due to the customer's application, increases the likelihood of the compact breaking in case it inadvertently falls. In order to

fully understand the invasive consequences of pressing on powders, it becomes important to fully appreciate the meaning of the K-value and of the recovery rate (fig. 1). In order to measure the softness of a powder, the K-value is calculated through the minimum force needed to obtain a 10% deformation. The recovery rate is the elasticity index, evaluated as the capacity of a powder to return to its previous condition after a 10% deformation (1). The highest recovery rate in powders reaches 35-40%, and this is the reason why, following the pressing operation (from 25 atm to 35 atm), the spherical powders become irreversibly spheroidal, with a consequent variation in the sensory domain.

With a moulded product, its typical oily feeling limits its use on certain application areas, especially on the eyes – in addition, an oily look is never appreciated. Another issue concerning moulded products is the impossibility to obtain a long lasting effect, because the volatile solvents which disperse resins cannot be used in the formulation.

The irreplaceable waxes in formulations also determine the basic opacity of the film besides increasing a perception of heaviness in the after-feel.

Cooked products partially bring the same issues as compact products: flaking, cracking, dusting and product breaking in case of a fall (much more likely than with a compact).

Below, we will see how it is possible to solve the issues discussed above through the formulation of a cohesive hybrid powder. An innovative concept aiming to sum the advantages of compact, moulded and baked products in order to avoid the disadvantages of these three forms and create a product presenting new sensory ways, still maintaining the functionality featuring them.

## What is the cohesive hybrid powder?

Cohesive hybrid powder is an elastic net of oils and polyamides which traps fillers (hosting emollients in their cavities), pigments and/or pearls (fig. 2). There are therefore fundamental differences from the point of view of texture and functionality. A new sensory window has been opened, thus allowing several concepts based on the emollients and fillers used. The cohesive hybrid powder is a technology which can be used for eye shadows, rouges and foundations. The use of different emollients and fillers will distinguish each of these categories of products without preset rules, then two foundations in the form of «hybrid cohesive powder» will bring different sensory features.

## Functional properties

### Greasiness

Cooked products do not contain any type of oil, therefore greasiness cannot be felt. Compact products usually contain a percentage of binders between 3% and 10%. This low quantity of emollients does not give a feeling of greasiness – unlike moulded products, where the latex made of waxes and oil will always give a greasy feeling. In the hybrid powder, the quantity of powders (up to 60% higher than in moulded products) and their high absorption capacity do not give a greasy feeling whatsoever. In addition, the absence of greasiness can be better understood if we think that approximately 60% of the oils is structural part of the net.

### Sensory differentiation

On the matter of sensory differentiation, it has already been said that a compact product is made of appro-

## Illustration of K value and recovery rate

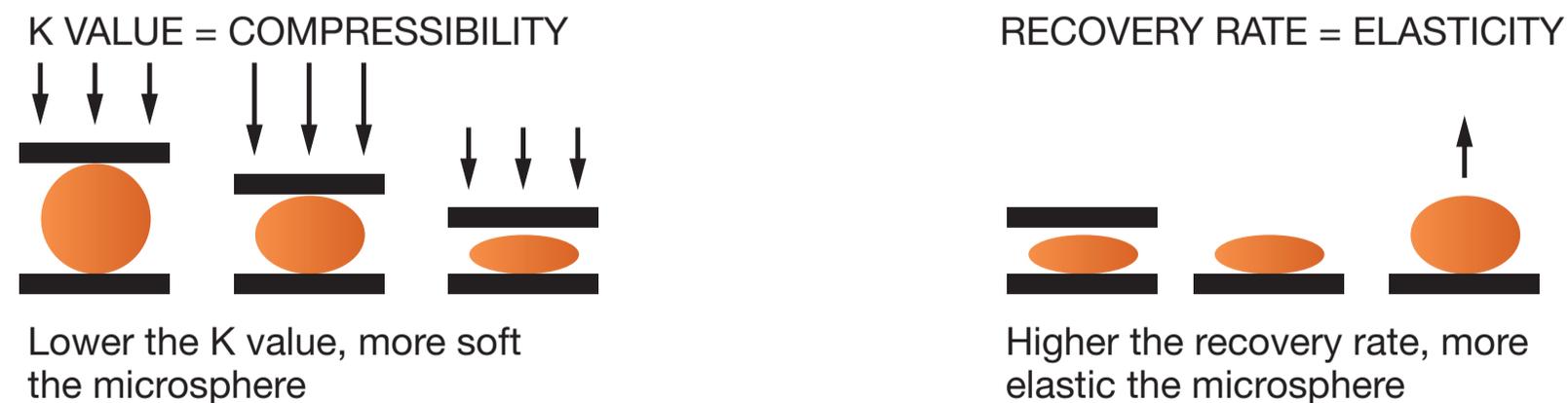
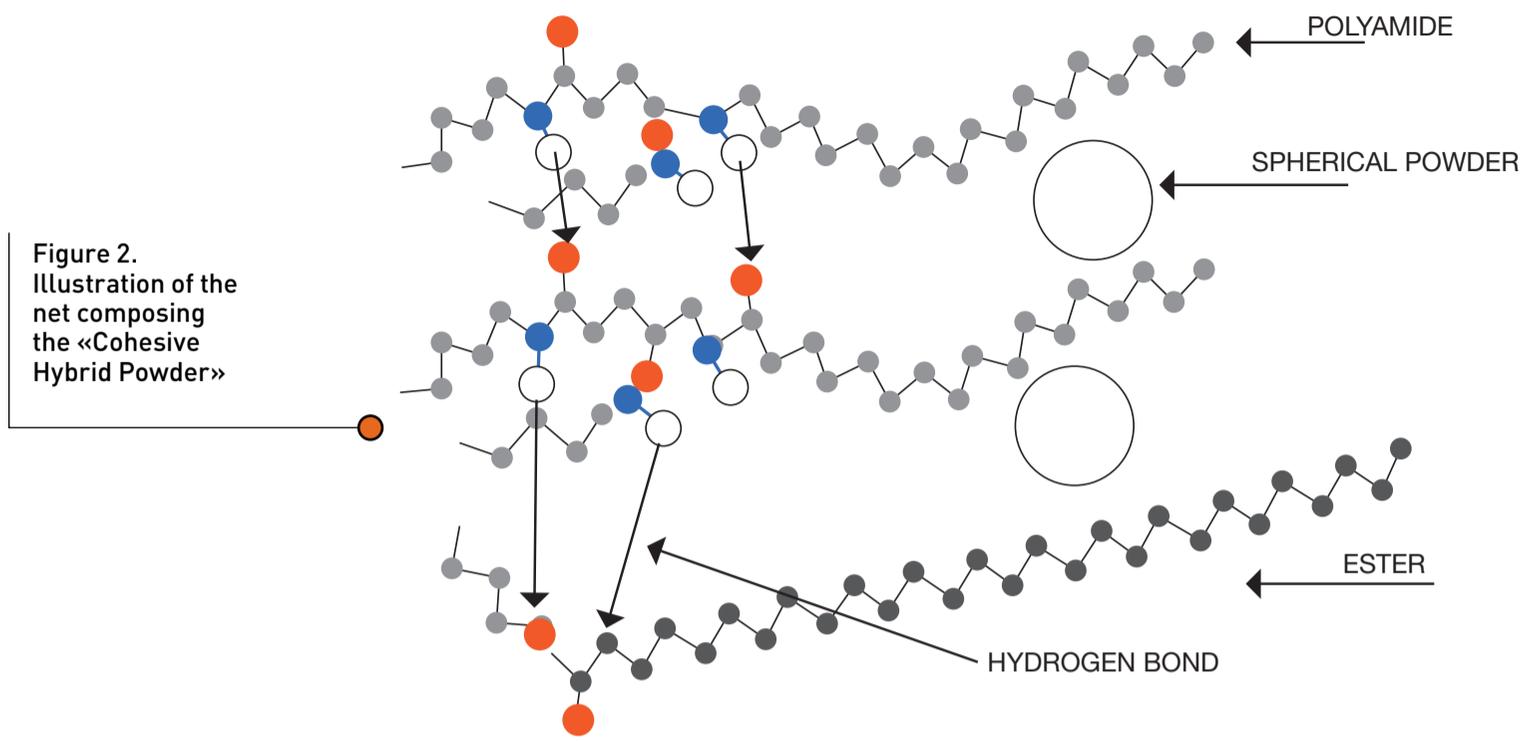


Figure 1. Graphic representation of the K-value and of the recovery rate

Illustration of cohesive hybrid powder network and recovery rate



MULTIFUNCTIONAL PROPERTIES COMPARISON



Figure 3. Comparison of functional properties

ximately 40% of talc powder, thus it is very difficult to create different textures («talc powder dilemma»). With baked products, there is no pressing and therefore no «talc powder dilemma», so the sensoriality can be varied. In moulded products, the possibility to use different emollients opens the way to different touches. Finally, in the hybrid cohesive powder, sensory differentiation can be reached thanks to spheres with different dimensions and different absorption capacity, and thanks to different oils. The sensory result is unique in its genre and variable, since the feeling during the application is the effect of the spheri-

cal powders rolling on an oily film which, due to the pressure exerted during the application, partly releases its filler.

**Pay-off**

Pay-off is the quantity of product released during the application. In the cohesive hybrid powder, the pay-off is high thanks to the net breaking, following a mechanical work due to the product being drawn, which decreases the internal cohesion and thus allows for an excellent product release (thixotropy).

**Microorganism proliferation**

Most fillers show absorption capacity. This is due to the presence of micro channels which run through the structure and which can carry liquids. The phenomenon of absorption can be also seen in a clad filler, though to a lesser extent. This means that the powders of compact and baked products contain even some water from atmospheric humidity, which is an issue in terms of microbiological stability. In moulded products and in the cohesive hybrid powder, which are anhydrous, there are no such issues, since active water is always below 0.5.

**Use of clad fillers**

During the years, the clad technology for fillers has been widely exploited. Today many clad particles are available, each with a unique feeling to it. The cladding is usually applied through a chemical reaction. In a compact, due to the high compression, this cladding tends to flake while still being linked to the particles. Therefore, the sensoriality perceived is different and it is not possible to fully exploit the sensory features that each clad particle can give. As the

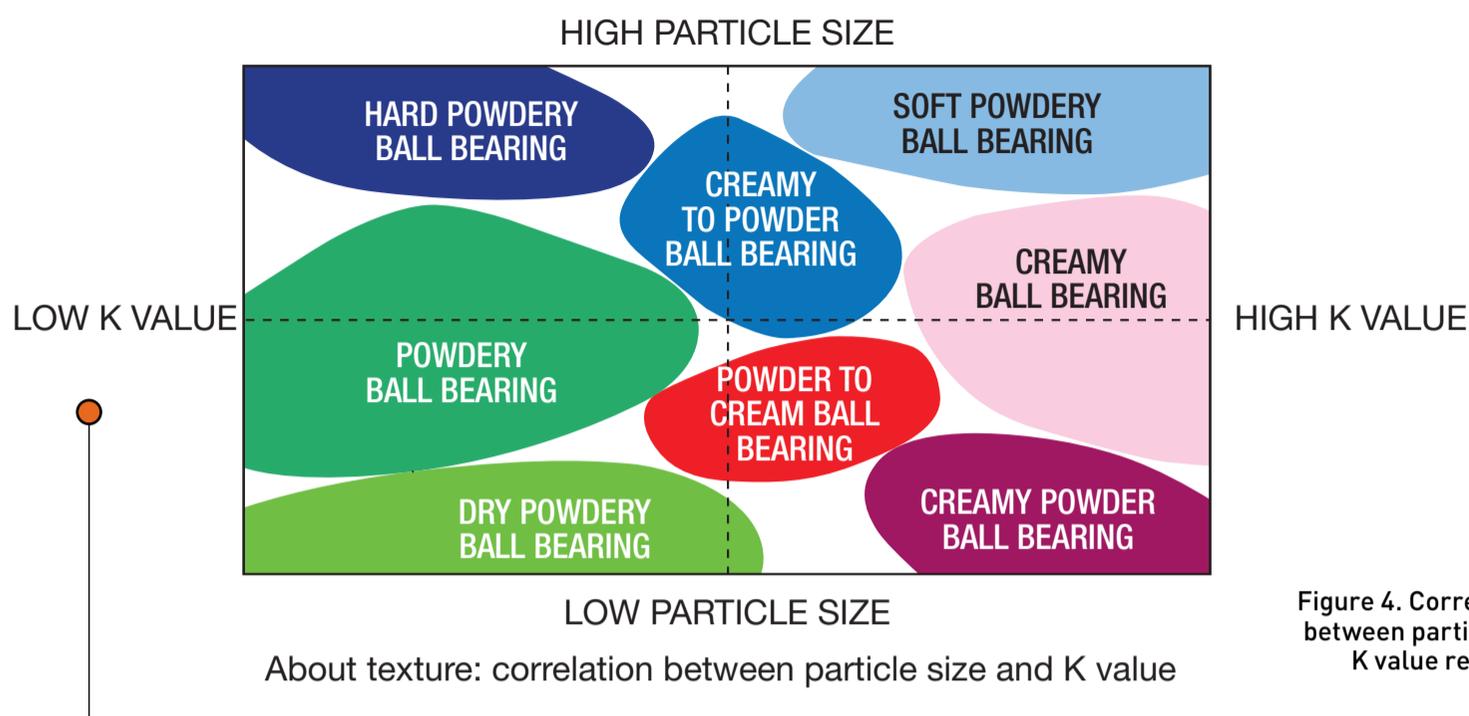


Figure 4. Correspondence between particle size and K value regarding the textures

Hybrid Powder is not pressed, the claddings will not present any sign of micro-flaking.

### Breaking following a fall

It happens to everybody to drop compact or baked make-up and find it broken. Consumers think this is an issue which should be solved. While cooked make-up is very fragile, the compact becomes stiff after being pressed. The stronger the pressure is, the stiffer the compact will be, but the lower the pay-off will be. On the other hand, a light pressure allows a softer application and a higher pay-off, but a lower stiffness. In both cases, both compact and baked make-up present some disadvantages, which brings to the question: «What is more important between the application (pay-off) and the structure (stiffness) of the product?». The answer is: «Both are important!». With the Cohesive Hybrid Powder, the elastic net which is created allows an excellent pay-off without compromising the structure of the product, which does not break even under mechanical strain. Even the high compressibility and elasticity of the powders (a destabilizing property in compacts due to the compression) contribute to it. In order to demonstrate this advantage, we have run a comparative drop test. We have bought a baked and 2 compact powders and we have dropped them from a height of 1 meter for 5 times. The measurement consists in counting how many times the product can fall without breaking. We have seen that the baked n° 1 breaks at the first fall, the compact n° 2 breaks at the fourth fall, the compact n° 3 after the third fall. After the fifth fall, the hybrid powder is still in perfect conditions. Usually drop tests are run from a height of 30 cm – by choosing to drop the product from a 1-meter height, we did not only put

ourselves in a consumer's shoes, but it is also obvious that if the product stays intact after falling 5 times from a 1-meter height, it will also stay intact after falling 5 times from a 30-centimeter height.

### Pick-up

The term «pick-up» is here used to express how easily a product can be drawn from its container. In these four cases, if the product is well-formulated, then the pick-up is great. The only category where the pick-up is lower is moulded make-up, because the waxy latex has a higher density than the net of the «Cohesive Hybrid Powder».

### Shading value

We can define the «shading value» as the range of shadowing possibilities of a product. Whereas compact and baked make-up can be applied and shaded with a brush, the moulded cannot, because the waxy latex prevents any type of adherence with brushes. The cohesive hybrid powder can be applied with the brush with the use of water. The net composing its structure is made of polyamides which are linked between them and with its oil through hydrogen bonds. When we dip a brush into water and touch the product surface with it, we cause a local destruction in the net, which is due to the water's ability to «catalyze hydrogen bonds», i.e. to create hydrogen bonds between water itself and the polyamides, thus making «unavailable» those bonds that, before the introduction of water, kept the structure together. Once the product is applied on the skin, the water evaporates and a new net is created. The product applied with water gives a satin effect, while, if applied with our fingertip or with a sponge, the effect is shining.

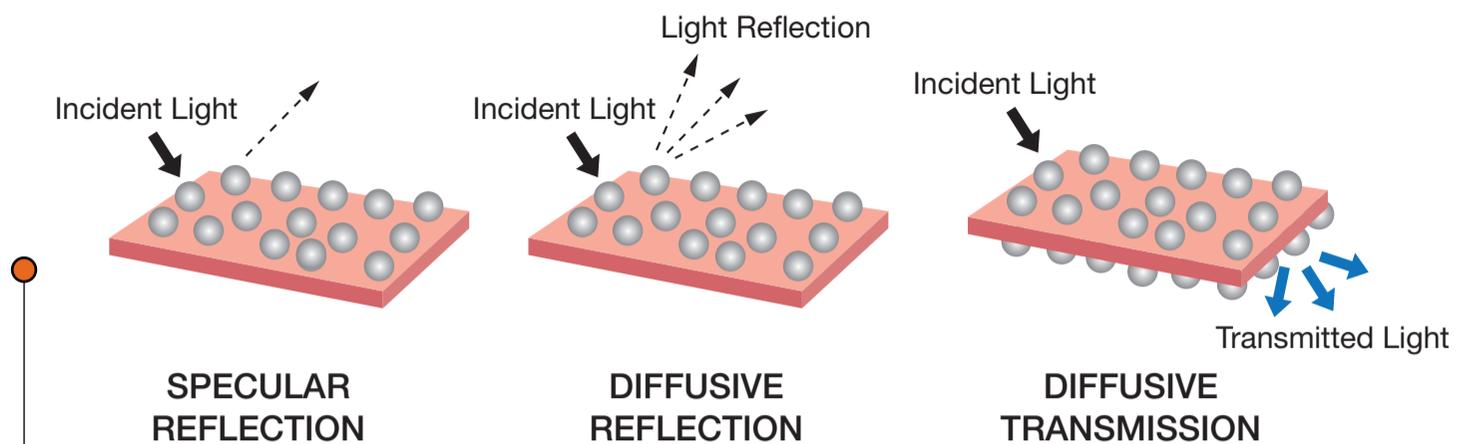


Figure 5. Picture of specular reflection, diffuse reflection and diffuse transmission

### Water-proof, long-lasting

Once compact make-up is applied, its binder tends to be absorbed by the skin, therefore it is like wearing some free powder which cannot last long. The same happens with baked make-up, because its texture is not adherent enough. Baked and compact make-up are not as waterproof as moulded make-up, which is anhydrous. Once the «Cohesive Hybrid Powder» is applied, the polyamides create electrostatic bonds with the amino acids of our skin, so, even if we add some water in this phase, it simply runs on the surface – water-proof effect. This happens because the electrostatic interactions between polyamides and amino acids are stronger than hydrogen bonds, therefore the structure is more stable. The electrostatic forces described above are also the cause of the long-lasting effect of the cohesive hybrid powder. In (fig. 3) we compared the functionalities of the four types of product.

### Sensory properties

We can divide sensoriality into «sensory phases», which are:

Contact Perception (CP): at the first contact between our fingers and the product, and running our fingers on the product

Application Perception (AP): running our fingers on our skin during the application of the product

Post-perception (PP): running our fingers on our skin in order to feel the effect of the product (2)

In the cohesive hybrid powder, the CP is that of softness. The reasons for this are to be found in the high compressibility of the powder used and in the destruction of the net due to the friction of our finger on the product, which is thus fluidized («thixotropy»). The AP is called «ball bearing», and it is due to the spheres rolling on a soft bearing made of emollients.

During the application, the light pressure put on these very compressible powders releases the oil within, which clears any obstruction to the rolling spheres. The free emollients (which are not a waxy latex) allow the product to have a higher shading value and pay-off, because a fluid has a higher diffusion coefficient than a semisolid. A high pay-off means an amplified sensory intensity.

The PP is powdery, because the net which was broken earlier recomposes itself, and the porous spheres, being very absorbent, restart trapping the oil. The sensory differentiation is based on the different powders and on the emollients used.

### Fillers

Not only the filler's shape, but also its dimension bring different perceptions, in figura 4 we can see that the smaller the particle size is, the lower the perception of each particle is. On the contrary, with large particle sizes we can almost distinctly feel the particles. In addition, the best ball bearing is obtained using particles of the same size.

With an eyeshadow, for example, the powdery perception is considered as a quality, therefore spherical fillers with extra large particles will be used – or, in order to obtain an optimal ball bearing, medium-large particles will be used. In a blush or a foundation, the sensoriality should be more creamy, so we will use fillers with extra small particles – or, in order to obtain an excellent ball bearing, the main characters will be medium-small particles.

### Emollients

Another fundamental variable in sensory differentiation between products is the type of emollients used. Emollients become part of the net and are partly absorbed by the microspheres. Their physicochemical

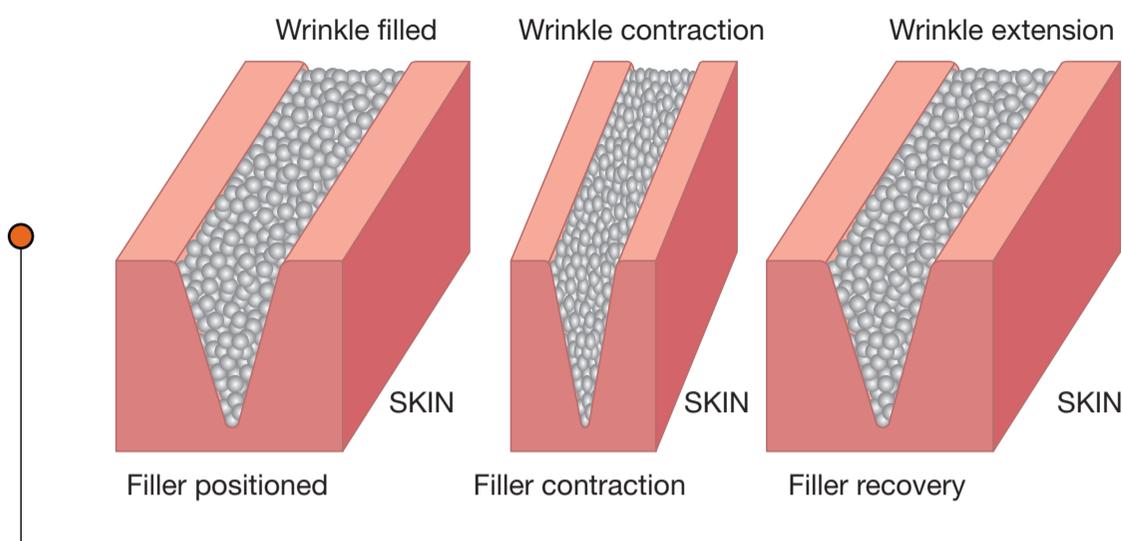


Figure 6. Picture of how fillers with a high K value and recovery rate can conceal wrinkles

nature influences both the sensory parameters and the properties of the applied product.

### Optical effects

The optical effects which can be obtained through the «Cohesive Hybrid Powder» are many and varied. The actors are the fillers, while the emollients play as supporting actors but are nonetheless important. The dimension and chemical composition of the fillers can vary according to the desired optical effect, therefore they determine and qualify the different categories of products.

The desired effects for an eyeshadow can be the matte effect and the shining effect.

Here these two effects are influenced by the presence of pearlescent materials in the formulation, but the use of oils with high refracting index and fillers with very intense specular reflection (fig. 5) are details which make the difference in obtaining a pronounced shining effect. In order to obtain a matte effect, the presence of fillers with very intense diffuse-reflection is necessary (fig. 5). In a blush or a foundation, the desired effects are low brightness and matte.

A low brightness in the film implies a lower greasy effect which would be quite unpleasant to the consumer, therefore emollients with a low refraction index will be used. The brightness is due to the sebum which is secreted by the sebaceous glands, therefore we can reach a sebum-regulating action by using very porous but rigid fillers (high absorbance), since the absorbed oil is slowly substituted by the sebum which will be removed by the plaster contained in the product itself. The presence of pigments implies an even bigger attention in using emollients with high soaking properties. The same principle of the matte eyeshadow works with a blush or an opaque foundation. A highly requested optical effect is concealing

the wrinkles through the soft-focus and filling effects. The soft-focus effect (5) can be reached with the use of fillers with high diffuse transmission (fig. 5). In all three types of product, the filling effect can be reached thanks to the high compressibility and elasticity of the spherical powders. These powders work as a wrinkle filler, thus reducing the visual perception. If these spheres did not have a high recovery rate and compressibility, then the facial mimicry, which dilates or compresses wrinkles, would push the filler out of them, thus highlighting them (fig. 6).

### Conclusions

The «Cohesive Hybrid Powder» represents a precise rheological profile, where the original formulation structure works as a base for and as a bond between the particles, thus introducing an innovative product to the market. The qualities of compact, baked and moulded make-up can coexist in one product which can overcome all the flaws of each of these three products. All the possible forms of ball bearing have brought to the discovery of new pleasant sensations. Finally, thanks to a new productive technology, it is possible to obtain the cohesive hybrid powder in tridimensional form.

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