CAPMAG ZN

TECHNICAL BULLETIN #1

CAPMAG® CHEMICAL UNIQUENESS: ATOMIC PROTECTION BY MAGNESIUM

INTRODUCTION

CAPMAG® technology is based on **atomic protection by magnesium** for trace-elements. CAPMAG® Zinc is the only innovation animal nutrition considering a **ternary oxide M-Zn-O** [with (M=Metal)]. Its formulation is based both on thermodynamic rules and on the control of crystallization degree.

UNIQUENESS: ATOMIC PROTECTION BY MAGNESIUM

CAPMAG®: THERMODYNAMIC EQUILIBRIUM OF MG-ZN-O SYSTEM

Together ZnO and MgO salts contains atoms in a metastable state. Following the thermodynamic laws, by combination of **superficial diffusion (Ds)** and **external energy**, Zn, Mg and O atoms could be reorganized on a ternary oxide: $Zn_xMg_{1-x}O$ structure of **CAPMAG® Zinc**, which is **the most stable organization** (Figure 1).

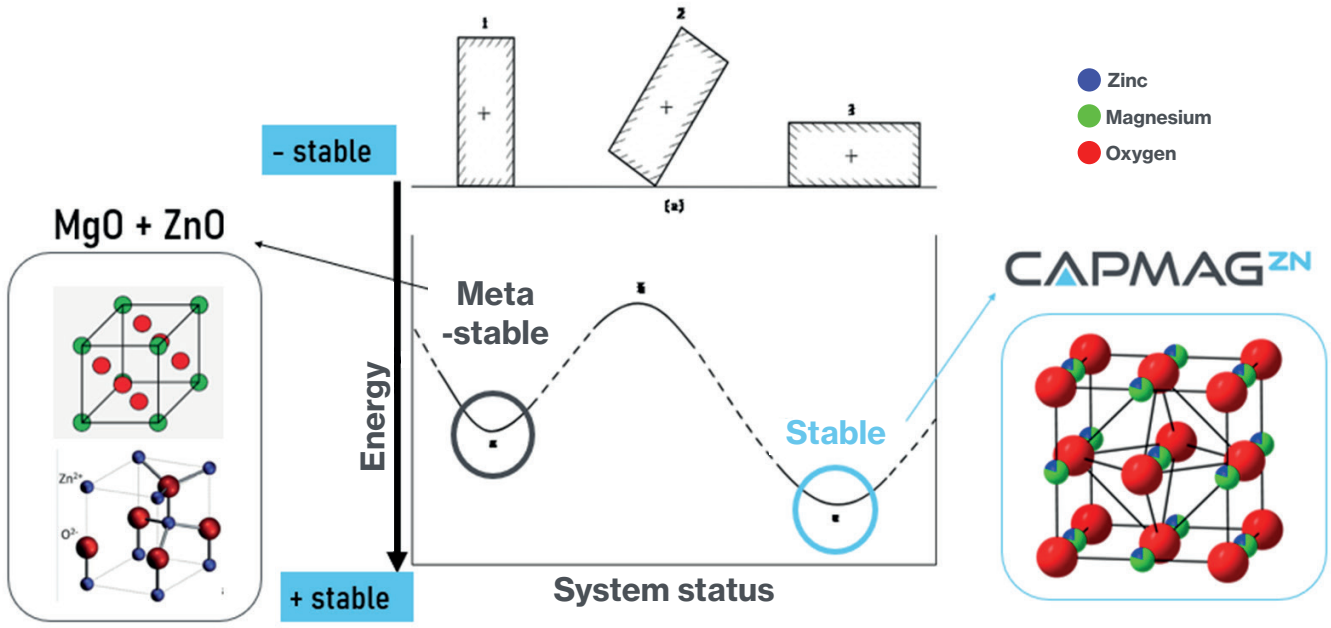
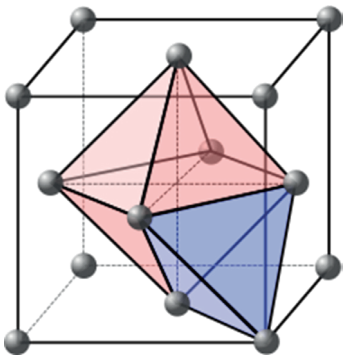


Figure 1: Schematic description of the system: from meta-stable mixture ZnO+ MgO to stable CAPMAG® structure.



Thanks to their similar cationic sizes:

Magnesium (Mg^{2+} (VI) = 0.72 Å) and Zinc **(Zn^{2+}(VI) = 0.74 Å)**

have the physico-chemical ability to substitute each other into their structures. In the cubic $Zn_xMg_{1-x}O$ structure, Zinc is substituting Magnesium in the octahedral site (Figure 2).

Figure 2: CFC structure with Octahedral (red) and tetrahedral (blue) sites

FINAL REFINEMENT: THE RIGHT CRYSTALLIZATION DEGREE

The uniqueness of **CAPMAG® Zinc** depends finally on **the perfect control of crystallization degree** of the $Zn_xMg_{1-x}O$ structure. It could be controlled by X-ray diffraction (XRD) thanks to the FWHM value (full width at half maximum) of the most intense diffraction peak of the structure (Figure 3).

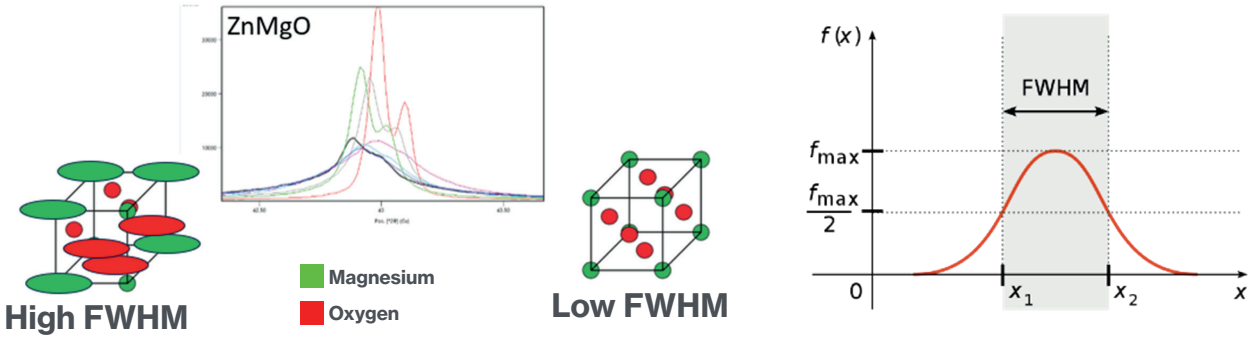


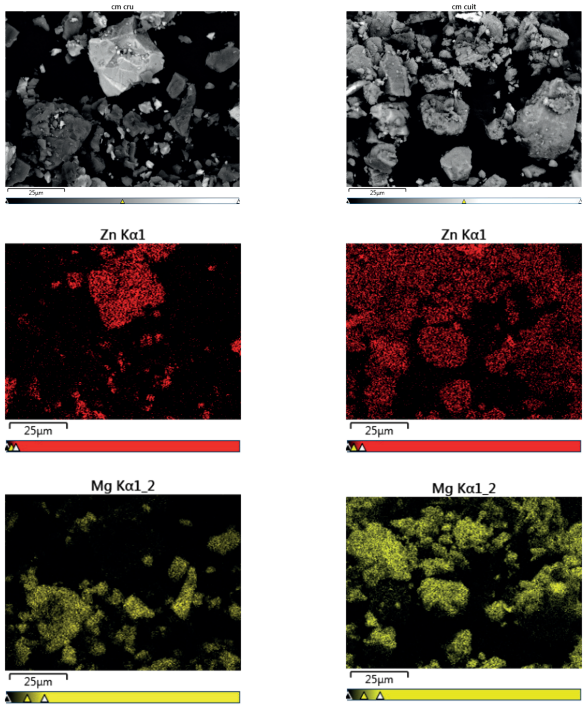
Figure 3 : FMWH focus in XRD for the 43° 2 thétas peak of MgO

FWHM leads to a visibility of atom positions inside the structure. If the atoms are exactly at the same distance from each other's, the structure will be very stable. At the opposite, if the structure contains atoms at several different distances from each other's, then this material will be less stable and more influenced by the environment.

To formulate **CAPMAG® Zinc**, intergranular diffusion (Di) is fixed to reach the efficient crystallization degree needed to maximize the biodisponibility in the animal.

COMPARISON WITH THE SIMPLE BLEND MGO + ZNO

MGO + ZNO ≠ CAPMAG ZN



By doing a cartography with scanning electron microscopy method (SEM), it is possible to have a localization of the chemical elements inside a material at microscopic scale (µm=10-6 m).

For a simple blend of MgO & ZnO, Mg and Zn atoms are in separate crystals (Å=10-10m) but also in separate grains (µm=10-6m). There is no reason why Magnesium should impact the behavior of Zinc.

With **CAPMAG®** Zinc, as Mg and Zn are in the same crystal and because µm>Å, then they are also in the same grains. Combined with XRD, SEM is an interesting way to observe the link between Mg and Zn in each grain of **CAPMAG®** Zinc (Figure 4).

Figure 4: Cartography of CAPMAG® Zinc VS "MgO + ZnO" by SEM. MgO + ZnO: Mg & Zn in separate grains(left) CAPMAG®: Mg & Zn both in same grains (right) – (Red : localization of Zn / Yellow : localization of Mg).

CONCLUSION

The uniqueness of CAPMAG® Zinc was reached thanks to six years of research looking for: **the right crystal structure & the right degree of crystallization**. Each single physico-chemical parameter was checked to maximize the absorption of Zinc by the animal.

TIMAB magnesium

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