Factors Affecting Gypsum Properties: A Summary This document analyzes factors influencing setting time, expansion, and strength of gypsum products. **Setting Time:** * **Water-to-Powder Ratio (W/P):** Higher W/P ratios delay setting due to reduced nuclei per volume, slowing crystallization. * **Fineness:** Finer hemihydrate particles accelerate setting due to increased dissolution rate and more numerous nuclei. * **Mixing:** Extended mixing shortens setting time by exposing more particles to water, forming more nuclei, and distributing them evenly. * **Temperature:** Setting is minimally affected between 0-50°C. Above 50°C, setting is retarded, and at 100°C, no setting occurs. * **Impurities:** Added gypsum shortens setting time by increasing potential nuclei. * **Retarders & Accelerators:** These are the most effective controls for setting time. Retarders (e.g., glue, borax) slow crystallization by reducing hemihydrate dissolution and coating nuclei. Accelerators (e.g., sodium chloride, potassium sulfate) speed up setting by enhancing hemihydrate dissolution, leading to quicker saturation. **Setting Expansion:** * **W/P Ratio:** Higher W/P reduces expansion due to fewer nuclei per unit volume, leading to less interaction and outward thrust. * **Chemicals (Accelerators & Retarders):** Both reduce expansion. Accelerators cause rapid initial crystallization, hindering subsequent growth. Retarders alter crystalline form, resulting in thicker, shorter crystals with less outward thrust. **Strength:** * **Excess Water:** Wet strength is lower than dry strength due to water reducing cohesion between crystals. * **Drying:** Removing excess water increases strength by enhancing cohesion between crystals. * **Porosity:** Higher W/P ratios increase porosity and reduce crystal density, impacting strength. * **Mixing Time:** Proper mixing enhances strength, but overmixing can weaken it by breaking crystals and hindering interlocking. * **Chemicals (Accelerators & Retarders):** Both reduce wet and dry strength by decreasing intercrystalline cohesion. **Tensile Strength:** This aspect is not directly addressed in the text. **Summary Table:** | Factor | Setting Time | Expansion | Strength | |---|---|---|---| | W/P Ratio | Increases | Decreases | Decreases | | Fineness | Decreases | Not mentioned | Not mentioned | | Mixing | Decreases | Not mentioned | Increases (optimally), Decreases (over-mixing) | | Temperature | Increases (above 50°C) | Not mentioned | Not mentioned | | Impurities (Gypsum) | Decreases | Not mentioned | Not mentioned | | Retarders | Increases | Decreases | Decreases | | Accelerators | Decreases | Decreases | Decreases | | Drying | Not applicable | Not applicable | Increases | | Porosity | Not applicable | Not applicable | Decreases | **Key Message:** Understanding the influence of various factors on gypsum properties is crucial for achieving desired performance in construction and other applications.