ACM Impact Modifier
Technical Guide & Processing Manual

Advanced Polymer Additives for Rigid and Semi-Rigid PVC Formulations

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Target Application: High-Speed Extrusion, Window Profiles, Heavy-Duty Pipes & Injection Molding

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1. Introduction & Chemical Composition

ACM Impact Modifier represents an advanced category of composite resin modifiers engineered specifically for Polyvinyl Chloride (PVC) formulations. Unlike traditional single-component impact modifiers, ACM is an Interpenetrating Polymer Network (IPN) copolymer synthesized by the precise graft copolymerization of lightly chlorinated high-density polyethylene (HDPE) and structured polyacrylate monomers (acrylic esters).

This dual-component synergy pairs the exceptional elastomeric flexibility of a linear flexible-chain polymer (chlorinated matrix) with the thermodynamic compatibility and fusion-promoting capabilities of an acrylic-based shell architecture. By integrating these two properties, ACM modifiers drastically improve the low-temperature toughness, surface finish, and processing margins of rigid PVC profiles, effectively reducing or entirely eliminating the reliance on separate processing aids (e.g., standard ACR resins).

2. Core Technical Specifications

The physical and chemical performance metrics of ACM parameters are systematically regulated to guarantee seamless processing characteristics and uniform particle distribution inside the dry-blend mixture.

2.1 Typical Physical Properties

Technical Index / Property	Unit	Standard Specification Value	Test Method Reference
Appearance	—	White, free-flowing powder	Visual Inspection
Bulk Density	g/cm³	0.45 – 0.55	GB/T 1636-2008
Sieve Residue (30 Mesh)	%	≤ 2.0	GB/T 2916
Volatile Matter Content	%	≤ 1.0	ASTM D5668
Chlorine Content	%	35 ± 2	Analytical Titration
Glass Transition Temp. (Tg)	°C	-45 to -55	DSC Analysis

3. Mechanisms of Toughness & Fusion Optimization

The mechanical failure of unmodified rigid PVC is characterized by unstable brittle fracture propagation. The addition of ACM creates a discrete "sea-island" micro-heterogeneous phase morphology within the continuous PVC phase domain.

When external stress or rapid impact is applied to the matrix, the finely dispersed rubbery domains of ACM act as stress concentrators, initiating localized, controlled micro-crazing and shear yielding. This process effectively dissipates massive kinetic energy before micro-cracks can expand into catastrophic part failure.

The Low-Temperature Thermodynamic Advantage

Traditional Chlorinated Polyethylene (CPE) modifiers suffer from a relatively high glass transition temperature threshold and poorer dispersion, which weakens mechanical impact properties at sub-zero temperatures. Because ACM possesses an acrylic graft component, the compatibility parameter (δ) between the modifier and PVC is optimized, yielding faster fusion, superior corner welding strength, and robust low-temperature performance down to **-20°C**.

4. Recommended Production Formulations

The operational dosages of ACM differ based on the processing system and chemical stabilizer framework. The following guide provides three standard production formulations optimized for balanced rigidity and high impact retention.

4.1 Standard Multi-Application Frameworks (Parts Per Hundred Resin - phr)

Component Ingredient	Profile Formulation (Ca-Zn)	Pipe Formulation (Lead)	Foam Board Matrix
PVC Resin (K-65 / K-57)	100.00	100.00	100.00
Calcium Carbonate (CaCO3)	5.00 – 8.00	10.00 – 15.00	25.00 – 40.00
ACM Impact Modifier	**4.00 – 6.00**	**3.50 – 5.00**	**6.00 – 8.00**
Calcium-Zinc (Ca-Zn) Stabilizer	4.50	—	4.50
Lead-Based Stabilizer Complex	—	3.50	—
Titanium Dioxide (TiO2 Rutile)	4.00	—	2.00
Lubricants (PE Wax / Stearic Acid)	0.60	0.45	1.20
AC Blowing Agent / Regulators	—	—	6.00 – 8.00

5. Processing Adjustments & Rheological Tuning

Due to the inclusion of high-molecular-weight polyacrylate chains within the ACM matrix, the melt viscosity and processing fusion characteristics differ from standard CPE additions:

- **Extruder Torque & Current:** Upon converting a processing system from CPE toACM, an increase in fusion speed may lead to a minor drop or shift in the motor current and head pressure. This indicates highly effective plasticization and reduced internal friction.
- **Lubrication Balancing:** To maximize output and prevent premature fusion (over-gelation), operators should slightly optimize external lubrication profiles. If melt pressure rises too early in the barrel zones, reducing the external lubricant (e.g., paraffin or oxidized PE wax) by 0.05–0.10 phr will stabilize the rheology curve.

• **Extrusion Temperature Profiles:** Recommended temperature zones for twin-screw extrusion of rigid profiles utilizing ACM are detailed below:

- **Zone 1: 165°C – 170°C**
- **Zone 2: 170°C – 175°C**
- **Zone 3: 175°C – 180°C**
- **Die Head: 185°C – 190°C**

6. Package, Storage, and Safety Instructions

ACM is packed in 25kg net weight composite paper-plastic bags or large-format bulk bags. It is classified as a non-hazardous, non-toxic industrial solid chemical. It must be kept away from direct sunlight, moisture, and high temperatures to avoid agglomeration (caking). Maintain a storage temperature below **35°C** for optimal shelf life retention of 24 months.

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