PDMS Full-Scenario Common Problem Troubleshooting Guide

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HiSiaddi is a new-type foreign trade service provider driven by dual engines of technology transformation and foreign trade services. It has established a "1+2+3+4=1" service system and can supply original factory sources of well-known brands for PDMS products. As a R&D-oriented new foreign trade service provider with over ten years of deep cultivation in the PDMS foreign trade market, HiSiaddi sorts out key points to note during the entire PDMS purchasing decision-making process from a professional perspective for your reference.

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I. Raw Material Source Troubleshooting

1.1 Defects of Basic Synthetic Raw Materials

Fault Manifestations

Deterioration of core properties including lubrication, mold release, defoaming, hydrophobicity, temperature resistance and damping of finished products; oil turns yellow, turbid, milky white, layered or precipitates impurities at the bottom; large batch-to-batch viscosity fluctuation, abnormal volatile content and unstable surface tension; shrinkage cavities, oil spots, failed defoaming, mold release residues and abnormal lubrication noise occur in application systems; heavy smoke and increased carbon deposition under high-temperature service; unqualified third-party test indicators including viscosity, volatile matter, flash point, acid value, moisture, mechanical impurities and heavy metals.

Troubleshooting Key Points

Dimethyl cyclosiloxane monomers with insufficient purity contain short-chain silanes, branched impurities and hydrogen-containing silicon impurities, disrupting the regular linear molecular structure; raw materials containing water and alcohol impurities lead to incomplete polymerization end-capping and residual active end groups, causing high volatility and oxidative yellowing of oil under high temperature; residual metal catalytic ions, acids and alkalis in raw materials continuously catalyze the cleavage of siloxane bonds, resulting in viscosity drift during storage and aggravated pyrolysis at high temperature; uneven monomer distillation ranges with mixed high and low molecular weights cause excessive oil volatility and unstable lubrication & damping performance; low-grade raw materials adulterated with mineral oil and white

oil are incompatible with silicone oil systems, leading to stratification, turbidity and defoaming failure.

Incoming Inspection Control

Precise kinematic viscosity testing; observation of color, clarity and low-temperature stability of appearance; quantitative testing of volatile matter, flash point, acid value and moisture; screening of mechanical impurities and insoluble substances; high-temperature thermal weight loss stability test; benchmark test of surface tension, defoaming and mold release performance; limit testing of heavy metals and harmful residues.

Control Scheme

Adopt high-purity narrow-distillation-range dimethyl cyclosiloxane raw materials, strictly control monomer impurities, moisture, metal ions and mixed oil adulteration; precisely control polymerization and end-capping processes to ensure regular linear molecular structure and stabilize viscosity, volatile and temperature resistance indicators; reject unqualified raw materials that are turbid & yellow, excessive volatile, drastically fluctuating in viscosity or mixed with foreign oil, so as to guarantee consistent and stable lubrication, defoaming, mold release and temperature resistance of oil products.

1.2 Defects of Polymerization, End-Capping and Catalytic Auxiliaries

Fault Manifestations

Excessive residual polymerization catalysts cause slow oxidation, deepened color and rising acid value of oil during long-term storage; unbalanced dosage ratio of end-capping agents leads to incomplete molecular terminal capping and residual hydroxyl & active groups, resulting in easy pyrolysis, volatilization and peculiar odor under high temperature; residual salts from neutralization auxiliaries raise oil ash content and tend to form coke deposits under high-temperature working conditions; impurity enrichment in recycled auxiliaries reduces oil transparency and generates tiny suspended particles; trace residual acids and alkalis induce catalytic aging, loss of gloss and cracking in downstream coating and rubber systems.

Troubleshooting Key Points

Incomplete removal of acidic and alkaline polymerization catalysts leaves trace catalytic components that continuously damage siloxane molecular chains; insufficient dosage of end-capping agents leaves residual active end groups and lowers thermal stability of products; incomplete water washing and neutralization trap inorganic salts and catalytic residues inside oil, causing coking and scaling at high temperature; recycled solvents carry foreign oil and polar impurities and reduce oil purity and compatibility.

Control Scheme

Adopt low-residue refined catalytic and end-capping auxiliaries with precise proportioning to achieve complete molecular end-capping; conduct multi-stage water washing and neutralization purification to thoroughly remove catalysts, salts, acids and alkali residues; implement full closed-loop purification to avoid impurity enrichment, lock the stable linear molecular structure of PDMS and improve temperature resistance, anti-aging and low-volatility properties.

1.3 Defects of Decolorization, Filtration and Vacuum Refining

Fault Manifestations

Incomplete decolorization leads to yellow oil and poor light transmittance, which cannot be applied to transparent coatings, daily chemicals and optical products; insufficient filtration precision leaves residual fine carbon powder, polymer particles and mechanical impurities, causing particles and pits in downstream coating and spraying processes; inadequate vacuum light removal process retains short-chain low-molecular silicone oil, resulting in excessive product volatile content, low flash point and heavy smoke at high temperature; incomplete refining leaves residual foreign oil and polar impurities, leading to uneven defoaming, mold release residues and system shrinkage cavities.

Troubleshooting Key Points

Saturated decolorization fillers fail to remove colored impurities generated by high-temperature oxidation; aging or damaged filter cartridges lose the ability to intercept fine solid impurities; insufficient vacuum temperature, vacuum degree and duration cannot fully remove light-component small molecules; incomplete refining stratification mixes polar impurities and foreign oil with silicone oil and impairs application compatibility.

1.4 Defects of Sealed Constant-Temperature Storage Protection

Fault Manifestations

PDMS linear molecules are stable at room temperature, but light components are prone to volatilization and surface oxidation under high temperature, aerobic and open environments; long-term open storage slightly raises oil viscosity, deepens color and increases volatile content; exposure to air dust impurities reduces oil transparency and introduces particulate matter; alternating high and low temperatures slowly drift oil physicochemical indicators and cause inconsistent application effects between batches.

II. Troubleshooting of Polymerization Refining, Filtration and Filling Processes

2.1 Out-of-Control Polymerization Temperature Control and Molecular Chain Regulation

Fault Manifestations

Excessively high polymerization temperature triggers molecular chain cleavage and recombination, generating disordered mixed high and low molecular weight distributions, which lead to high oil volatility, unstable viscosity and poor temperature resistance; excessively low temperature results in incomplete polymerization and enrichment of short-chain small molecules, bringing fast defoaming but poor foam inhibition and severe mold release residues; uneven stirring creates inconsistent polymerization degrees in local areas, insufficient overall oil uniformity and fluctuating lubrication & damping effects; excessive catalyst dosage causes continuous catalytic aging of oil during its shelf life.

Optimization Scheme

Adopt segmented constant-temperature closed polymerization process with precise temperature and time control to stabilize regular linear molecular chains; remove light-component small molecules via gradient vacuum to unify molecular weight distribution; implement full closed oxygen-isolated production to avoid oxidative discoloration and impurity mixing, ensuring accurate viscosity, low volatility and excellent thermal stability of PDMS of all viscosity grades.

2.2 Defects of Light Removal, Decolorization and Purification Processes

1. Failed light removal: Residual short-chain small molecules cause excessive product volatile matter, low flash point, heavy smoke and strong odor at high temperature, failing to meet standards for high-end electronic and food-grade applications.
2. Incomplete decolorization and purification: Residual colored oxidized impurities and foreign oil lead to yellow and turbid oil, making it incompatible with transparent daily chemicals and high-gloss coatings.
3. Failed impurity removal: Residual mechanical impurities, salts and catalytic residues cause coking at high temperature, wear of lubricating surfaces and particle defects in spraying.

2.3 Problems in Maturation, Precision Filtration and Closed Filling Processes

Fault Manifestations

Insufficient maturation time results in poor molecular homogeneity and inconsistent viscosity & performance within the same batch; inadequate filtration equipment precision or damaged filter screens allow fine impurities to flow into finished products; open workshop filling with heavy dust introduces

impurities and slight oxidative discoloration into oil; residual old oil in filling pipelines causes cross-contamination between new and old oil and fluctuating batch performance; filling under high temperature prematurely volatilizes light components and generates falsely high viscosity readings.

III. Full-Link Troubleshooting of Packaging, Warehousing and Logistics

3.1 Defects of Packaging Sealing Protection

Fault Manifestations

Poor sealing of ordinary packaging allows air intake and oxidation during long-term storage, leading to yellow oil and rising acid value; breathable bucket lids slowly volatilize light components, gradually increasing oil viscosity and altering product performance year by year; incompatible gasket materials precipitate impurities and contaminate oil, triggering shrinkage cavities and precipitates in downstream systems; lack of light-shielding protection accelerates aging and discoloration of trace components under long-term light exposure.

Control Scheme

Adopt food-grade/industrial-grade high-barrier sealed HDPE barrels with thickened oil-resistant sealing gaskets for full closed light-shield storage; fill high-end grades with nitrogen to isolate oxygen, dust and water vapor, so as to stabilize oil viscosity, color, volatile content and purity indicators for long-term storage.

3. Abnormal Warehouse Environment Control

Standard storage conditions: Cool, constant-temperature and closed warehouse with temperature controlled at 10–30℃, dry, ventilated and clean storage space; prohibited conditions: high-temperature sun exposure, sub-zero freezing, high dust accumulation; prohibited co-storage materials: strong oxidants, strong acids, strong alkalis, mineral oil and organic solvents; keep away from heat sources, open flames and heating equipment.

Fault Manifestations

Ambient temperature above 35℃ accelerates volatilization of light components, oxidative yellowing and viscosity drift of oil; sub-zero environments reduce fluidity of high-viscosity oil, making it thick and solid and unavailable for normal use before application; heavy warehouse dust mixes solid impurities into oil and generates particles in spraying and coating processes; co-storage with oxidants and solvents triggers slight oil swelling, deterioration and compatibility failure; large day-night temperature differences form condensed water on barrel walls, introducing trace water into oil and causing uneven defoaming and abnormal foaming of systems.

3.3 Logistics Transportation Damages

High-temperature sun exposure in carriages causes thermal oxidation and volatilization of light components of oil, deteriorating product performance; low-temperature transportation without thermal insulation solidifies high-viscosity oil and results in poor fluidity and uneven dispersion upon arrival; packaging extrusion damage or loose bucket lids allow air, water and dust impurities to enter oil; long-distance bumping causes oil stratification and uneven local concentration, leading to fluctuating application effects.

IV. Troubleshooting of Faults in Full-Industry Application Scenarios

4.1 Industrial Defoaming Scenarios (Coatings, Inks, Water Treatment, Emulsions, Adhesives)

Common Faults

Slow defoaming speed and short foam inhibition duration with repeated foaming of systems; shrinkage cavities, pinholes, oil spots and floating oil after addition; turbid and loss of transparency in transparent systems with precipitated silicone oil particles; rapid defoaming failure and storage stratification in high-alkali systems; large defoaming effect differences between batches.

Troubleshooting Key Points

Mismatched oil molecular weight (excessively high or low viscosity) unbalances defoaming and foam inhibition; excessive residual small molecules lead to poor system compatibility, floating oil and shrinkage cavities; foreign oil and polar impurities in oil disrupt emulsion balance and cause stratification & turbidity; defoaming activity decays rapidly in high-pH alkaline filler systems; improper addition ratio and uneven stirring generate defects from excessive local concentration.

4.2 Rubber, Plastic and Hardware Mold Release Scenarios

Common Faults

High mold release resistance and incomplete demolding; oil mist, oil spots and glossy surfaces on products, impairing subsequent spraying and printing; short mold release timeliness with recurring mold adhesion after continuous production; heavy smoke, carbon deposition and hard-to-clean residues under high mold temperature; unstable mold release effects between batches.

Troubleshooting Key Points

Incorrect viscosity selection causes uneven film formation and unbalanced thickness of mold release film; excessive oil volatile matter rapidly loses at high mold temperature and generates carbon deposition residues; insufficient oil purity leads to discontinuous film and mold release failure due to impurities;

uneven spraying and coating creates local film-free areas and mold adhesion; excessive oil residues form inert films and reduce adhesion of subsequent paint spraying.

4.3 Mechanical Lubrication, Damping and Buffering Scenarios

Common Faults

Abnormal lubrication noise and dry jamming of precision bearings and guide rails; unstable damping resistance with speed drift and damping creep; large viscosity variation under high and low temperatures, resulting in jamming at low temperature and failure from thinning at high temperature; severe carbon deposition, sludge and wear after long-term operation; loud equipment noise and unstable operation.

Troubleshooting Key Points

Wide oil molecular weight distribution causes poor viscosity stability under high and low temperatures; residual light components easily run off at high temperature and cannot form durable lubricating films; residual impurities and carbon deposition precursors generate scaling and sludge during long-term operation; viscosity mismatches equipment working conditions; oil oxidation during storage degrades lubrication performance.

4.4 Daily Washing, Beauty and Skin Care Scenarios

Common Faults

Turbid paste, stratification and precipitated oil phase; dry, greasy texture and severe balling during application; poor product light transmittance with tiny white spot particles; oil-water separation and poor stability after long-term storage; obvious batch differences in hand feel and gloss.

Troubleshooting Key Points

Industrial-grade oil adulterated with foreign oil and impurities shows poor compatibility with daily chemical formulas; excessive residual small molecules conflict with surfactant systems; insufficient oil purity with mechanical particles generates white spot particles in paste; improper molecular weight selection leads to insufficient smoothness or excessive greasiness; oxidative yellowing during storage impairs finished product hue.

4.5 High-Temperature Resistant, Insulating and Waterproof Protection Scenarios

Common Faults

Rapid volatilization, heavy smoke and loss of oil film under high-temperature working conditions; low insulation resistance and unstable insulation performance; poor water repellent effect with spread water film instead of

water repellency; oxidative thickening and coking after long-term high-temperature use; uneven coating thickness leading to failed protection.

Troubleshooting Key Points

Incomplete removal of light components results in insufficient temperature resistance grade; low oil purity with abundant impurities causes easy oxidative coking at high temperature; incomplete molecular end-capping triggers pyrolysis failure at high temperature; insufficient coating dosage and uneven distribution cannot form complete protective films.

4.6 Microfluidic, Laboratory & Scientific Research PDMS Curing Application Scenarios

Common Faults

Sticky cured adhesive layers, incomplete curing and abnormal hardness; microchannel swelling, deformation and delamination; adsorption loss of drugs and detection components with low recovery rate; vulcanization inhibition and failed normal crosslinking of systems.

Troubleshooting Key Points

Sulfur and amine impurities in oil poison platinum catalysts and block curing reactions; residual unend-capped active groups interfere with crosslinking reactions; severe residual oligomers precipitate and swell microstructures; contact with non-polar organic solvents causes swelling and deformation of PDMS substrates.

V. Troubleshooting Module for Abnormal Physicochemical Indicators

5.1 Root Cause Determination of Core Performance Degradation

Unbalanced molecular weight control in polymerization reaction and excessive residual light components lead to high volatility and poor temperature resistance; incomplete refining impurity removal enriches foreign oil, particles and salt impurities, causing compatibility failure and particle defects; high-temperature and aerobic storage induce oil oxidation and volatilization of small molecules, resulting in viscosity drift and color deepening; residual impurities catalyze aging and continuously attenuate core functions including defoaming, mold release, lubrication and insulation.

Qualification Standard (Industrial/Daily Chemical/Scientific Research Grade Dimethyl Silicone Oil PDMS)

Colorless, transparent and clear oily liquid, free of turbidity, precipitation, suspended impurities and peculiar odor; viscosity accurately matches corresponding specifications with uniform molecular weight distribution; volatile matter ≤1.0%, moisture ≤0.05%, acid value ≤0.01mgKOH/g, qualified flash point and excellent high-temperature thermal stability; good compatibility

with conventional emulsion, coating and rubber & plastic systems, uniform defoaming, clean mold release and stable lubrication without stratification or deterioration after long-term storage.

5.2 List of Abnormal Physicochemical Problems

1. Yellow discoloration of oil: High-temperature oxidation, light aging, residual raw material impurities, long-term open storage
2. Turbidity, stratification and suspended particles: Mechanical impurities, foreign oil adulteration, precipitated tiny particles, mixed moisture
3. Excessive volatile matter and low flash point: Residual short-chain small molecules, incomplete light removal process
4. Unstable viscosity drift: Volatilization of light components, oxidative recombination of molecules, uneven batch polymerization
5. Failed defoaming, shrinkage cavities and floating oil: Mismatched molecular weight, excessive small molecules, system compatibility conflict, impurity interference
6. Mold release residues, carbon deposition and smoke generation: Insufficient purity, excessive volatility, poor high-temperature stability
7. Unstable lubrication and damping: Wide molecular weight distribution, impurity carbon deposition, oil aging
8. Stratification and balling of daily chemical paste: Low oil purity, poor surfactant compatibility, excessive residual small molecules
9. Curing inhibition and swelling deformation: Residual sulfur/amine impurities, oligomer precipitation, solvent incompatibility
10. Poor storage stability: Failed sealing, air intake oxidation, dust and water vapor contamination

VI. Rapid Troubleshooting Process for Customer Complaints by Grade

6.1 Level 1 Fault (Unqualified Core Indicators)

Fault scope: Severe viscosity deviation, excessive volatile matter/moisture/acid value, turbid & yellow oil with impurities, complete failure of defoaming/mold release/lubrication, unqualified third-party testing.

Troubleshooting sequence: Retest viscosity of retained samples → Physicochemical testing of volatile matter, moisture and acid value → Appearance impurity screening → High-temperature thermal stability test → Benchmark test of defoaming/mold release/lubrication performance → Check batch COA reports → Review process records of polymerization, light removal, filtration and filling → Verify raw material quality inspection and warehouse storage records.

6.2 Level 2 Fault (Application Function Faults)

Fault scope: System shrinkage cavities & floating oil, poor defoaming & foam inhibition, mold adhesion & release residues, abnormal lubrication noise & jamming, stratification & balling of daily chemicals, poor curing & swelling deformation, carbon deposition & smoke generation at high temperature.
Troubleshooting sequence: Confirm working temperature, system pH, addition ratio, stirring process and matched viscosity model; Check whether oil is stored under high temperature & open environment with oxidative deterioration and impurity contamination; Verify construction addition, coating and curing specifications; Distinguish real quality defects from pseudo-faults caused by model selection errors, improper construction and system incompatibility.

6.3 Level 3 Fault (Slight Sensory & Physical Defects)

Fault scope: Slightly pale yellow oil, tiny suspended light spots, small batch viscosity fluctuation, slight grease odor.
Troubleshooting sequence: Check high-temperature heat accumulation in warehouse, condensed water from large day-night temperature differences, sun exposure and extrusion during logistics; Inspect packaging sealing and light-shielding performance; Retest full set of physicochemical and application performance; Distinguish normal minor fluctuations from real deterioration and failure.

VII. Full-Process Prevention and Optimization Scheme

1. Raw Material and Polymerization Control: Adopt high-purity narrow-distillation-range dimethylsiloxane monomers, strictly control foreign oil, moisture, metal ions and active impurities; Implement segmented constant-temperature closed polymerization to precisely regulate molecular weight and guarantee regular linear molecular chains; Conduct multi-stage gradient vacuum light removal, deep activated carbon decolorization and precision filtration impurity removal to thoroughly eliminate small molecules, colored impurities, mechanical particles and catalytic residues, fundamentally delivering products with high purity, low volatility, high stability and strong compatibility.
2. Production Process Optimization: Full closed oxygen-isolated production to avoid oxidative discoloration and dust contamination; Complete end-capping process eliminates active end groups and improves high-temperature resistance and anti-pyrolysis performance; Multi-stage water washing removes acid, alkali and salt residues to prevent high-temperature coking and aging; Constant-temperature maturation and homogenization unify batch viscosity and molecular

weight distribution; Precision filtration and closed filling in clean workshops eliminate secondary pollution and performance fluctuation.

3. Packaging, Warehousing and Logistics Control: High-barrier sealed light-shield packaging to isolate oxygen, water vapor and dust; Full-process storage at 10–30℃ in dry and cool warehouses, away from heat sources, oxidants, organic solvents and open flames; Constant-temperature protection during logistics to avoid sun exposure, freezing, packaging damage and leakage, preventing oil oxidation, volatilization, deterioration and viscosity drift.
4. Standardized Terminal Application: Precisely match corresponding viscosity specifications according to working conditions to avoid model selection errors; Fully stir before addition and feed materials in gradient proportion with uniform mixing to prevent shrinkage cavities and floating oil from excessive local concentration; Select low-volatility refined grades for high-temperature working conditions to reduce carbon deposition, smoke and residues; Prioritize high-purity decolorized refined grades for daily chemical and transparent systems; Avoid contact with sulfur and amine inhibitors in scientific research curing systems to prevent curing failure; Store finished systems in closed and light-shield environments to stabilize defoaming, mold release, lubrication, hydrophobic, insulating and curing performance and eliminate all types of application defects.

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