



FARSOON 3D PRINTED AlMgSc ALLOY BLADES FOR 2022 WINTER OLYMPIC SHORT TRACK SPEED SKATING



- Blade Frame**
 - > Streamlined design with customized internal structural channels
 - > High-strength AlMgSc alloy for increased performance
 - > Weight reduction over 20%
- Blade Stanchion**
 - > Truss structure geometry
 - > Integrated design for increased stiffness and strength

Figure 1: Design iteration process: skate blades featuring light-weight and topology optimization.
Image Courtesy: Farsoon Technologies

↓ Project Overview

CHALLENGES	Heavy Blades Limitation to Movement Limited Blade Strength
SOLUTION	Farsoon FS421M Metal System
KEY BENEFITS	Reduced Weight Flexibility with Movement Better Ice Grip

Material Innovation with High-performance AlMgSc alloy - Through Additive Manufacturing.

The 2022 Beijing Winter Olympics draw to a close on last Sunday, with Chinese Short Track Speed Skating team cemented their new legacy with 2 gold medals and a record-setting performance in the 500m. Being one of the three skating disciplines at the Winter Olympics alongside Figure Skating and Speed Skating, Short Track Speed Skating evolves higher level of competitiveness of positioning in a shorter distance. High quality skate blades, are the essential equipment in assuring the best performance for the skaters.

In early 2021, Farsoon Technologies signed a collaboration agreement with the Chinese Olympic Committee to develop the new generation skate blades for the athletes. Taking the unique advantage of the additive manufacturing, the brand-new ice skate blades are produced with the innovative **AlMgSc alloy** material, featuring light-weight, improved strength and customized design for comprehensive performance.

↓ Material Innovation

The skate blades are typically made of tempered carbon steel with chrome coating or aluminum for a reduced weight. Developed from the traditional AlMg alloy, the **AlMgSc (aluminum-magnesium-scandium)** alloy is a new generation material customized for structural parts used in aerospace and automotive industries; the material features higher strength, excellent plasticity, and high temperature resistance (250°C).

Thanks to the truly open Farsoon metal systems, Farsoon R&D team is able to fine-tuned the processing

parameters of AlMgSc alloy and tested the mechanical properties such as strength, toughness, and fatigue. After a series of iterations, AlMgSc blades are additively produced with Farsoon's metal laser sintering system **FS421M** with the best optimized parameters; the performance of the AlMgSc blades offers increased performance of lateral and tangential strength of the blades during the complex and rapid movements, compared to traditional aluminum alloy blades.

↓ Lightweight & Streamlined Design

At the beginning of this project, a series of dynamic data of each skater are collected for analyzing the stress on the blades and stanchions during the starting, speeding, relays and turns. According to the data, Farsoon application R&D team conducted a variety of complex "design-build-test" topology optimization on the blade design for the best **streamlined geometry, with a significant weight reduction over 20% compared with the traditional blade.** The new designs also meet the requirements for quick installation, positioning and processing of the blades.

"Farsoon's 3D printed skate blades showcases better flexibility in use due to the reduced weight, which offers smoother and better ice grip at cornering and sharp turns." A Short Track Speed Skater commented, "During our regular tests under many extreme conditions the optimized blades can successfully withstand the mechanical pressure generated by both intensive starting and fast sliding."



Figure 2: The speed skating technician measures the radius of Farsoon's 3D printed blades. Image Courtesy: Farsoon Technologies

Mechanical Properties	Unit	Result
Tensile Strength (R_m)	MPa	559
Plasticity Elongation Strength ($R_{p0.2}$)	MPa	557
Elongation After Brake (A)	%	11.2

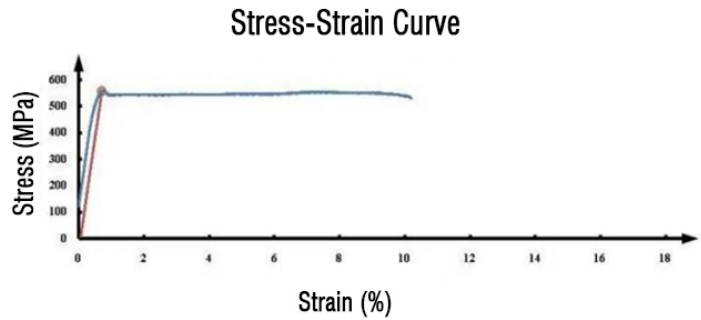


Figure 3: Tensile test result.
Image Courtesy: Farsoon Technologies

Item	Blade Frame		Blade Stanchion					Total Weight
	17.5	17	+7	+6	+5	+4	+3	
Blade Models	17.5	17	+7	+6	+5	+4	+3	17.5、+6
Traditional Blade (g)	252.84	245.59	36.7	36.1	36	31.2	30.1	288.94
Additively Optimized Blade (g)	173.31	168.99	33.86	33.60	32.73	32.06	31.12	206.91
Weight Reduction (g)	79.53	76.60	2.84	2.50	3.27	-0.86	-1.1	82.03
Weight Reduction Percentage (%)	31.45	31.19	7.74	6.93	9.08	-2.76	-3.65	28.39

Figure 4: Blades weight comparison: Traditional vs additive manufacturing.
Image Courtesy: Farsoon Technologies

↓ About Farsoon

OPEN FOR INDUSTRY - Farsoon Technologies, founded in 2009, is a global manufacturer and supplier of industrial level polymer and metal laser sintering systems. Farsoon is the leading supplier of industrial AM technology in China with increasing growth in the international market. In 2017, Farsoon released the first of a new series of machines under the revolutionary Continuous Additive Manufacturing Solution (CAMS), and established Farsoon Technologies-Americas in Austin, Texas, USA. In 2018, Farsoon Europe GmbH was established in Stuttgart, Germany to expand direct operations to Europe. Farsoon is committed to developing AM towards its true manufacturing potential and providing customers with best-in-class systems, materials, software, applications and services. Learn more: www.farsoon.com

↓ Farsoon's Plastic Laser PBF Systems

▼ FS721M



▼ FS421M



▼ FS301M



▼ FS273M



▼ FS121M



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