

Inside the beam splitter



Overview

Infrared Spectroscopy: Beam Splitters and Detector Physics Explained Two components really drive this process: the beam splitter and the detector. The beam.

Key Takeaways

A beam splitter typically consists of either two cemented prisms forming a cube or a coated glass plate, with specialized coatings or adhesives controlling the ratio of transmitted and reflected light.

Cube Beam Splitters

Cube beam splitters are constructed by cementing two right-angle triangular prisms together at their hypotenuse faces to form a cubic shape. The interface between the prisms is often coated with a thin layer of adhesive, such as polyester, epoxy, or urethane-based resins, which can be adjusted in thickness to achieve a desired transmission-to-reflection ratio for a specific wavelength of light. Historically, natural resins like Canada balsam were used.

The adhesive layer can exploit frustrated total internal reflection (FTIR) to split light evenly or at a specified ratio. Additional dielectric or metallic coatings may be applied to the hypotenuse to further control reflection, transmission, or polarization properties, and these coatings are protected from scratches and dust inside the cube structure.



Plate Beam Splitters

Plate beam splitters consist of a thin, flat glass plate with a partially reflective coating on the surface facing the incident light. Common coatings include aluminum or dielectric films, which determine the proportion of light reflected versus transmitted. The opposite side of the plate often has an anti-reflection (AR) coating to minimize unwanted reflections and ghost images.

Plate beam splitters are typically used at a 45° angle of incidence, and the coating design can be fine-tuned to achieve specific polarization and wavelength-dependent splitting.

Specialized Designs

Some beam splitters use half-silvered mirrors or pellicle films, which are extremely thin and flexible, to reduce absorption and interference effects. Other designs, like the Swiss-cheese or polka-dot beam splitters, feature perforated or patterned metallic coatings to achieve precise reflection/transmission ratios. In infrared applications, substrates such as Calcium Fluoride (CaF_2), Zinc Selenide (ZnSe), or Potassium Bromide (KBr) are used, with coatings tailored for mid- to far-infrared wavelengths.

Summary

Inside a beam splitter, the core structure—whether a cube of cemented prisms or a coated plate—works in combination with adhesives, metallic or dielectric coatings, and sometimes patterned surfaces to control how light is split. The choice of materials, coatings, and geometry directly affects efficiency, polarization behavior, wavelength response, and optical stability, making the internal structure critical for applications in interferometry, spectroscopy, and imaging systems.

Article Content

Infrared Spectroscopy: Beam Splitters and Detector Physics Explained

Two components really drive this process: the beam splitter and the detector. The beam splitter splits and then recombines infrared radiation, while the detector picks up the resulting signal.

Beam Splitters – optical power splitter, beamsplitter, thin-film ...

Plate beam splitters use a partially reflective coating on a transparent substrate, while cube beam splitters consist of two prisms joined at a coated interface inside the cube.

What are Beamsplitters?

Beamsplitters are optical components used to split incident light at a designated ratio into two separate beams. Additionally, beamsplitters can be used in reverse

3.1 Beam-splitters: physics against logic | Introduction to

Let us introduce a second beam-splitter and place two normal mirrors so that both paths intersect at the second beam-splitter, as well as putting a detector at each

How Beamsplitters Work: Principles and Applications

Beamsplitters are fundamental components in optical engineering, serving to precisely divide a single input beam of light into two distinct output beams. This division allows for the

Thorlabs · Optical Beamsplitters

Thorlabs offers a wide range of optical beamsplitters. Our plate beamsplitters have a coated front surface that determines the beam splitting ratio while the back

Introduction to Prisms and Beamsplitters

For optimum results, the incident light beam should enter the beamsplitter through the prism that has been coated with reflecting film so that reflection occurs before

How Do Optical Beam Splitters Work & Applications

Optical beam splitters are important components across multiple optical systems since they serve applications throughout telecommunications

Optical Beamsplitters Explained | Cube & Polarizing Types

Laser beam splitters separate a laser beam into two sections and are typically designed to reflect part of the beam, either differentiated by wavelength or

Beam Splitter

A beam splitter is defined as an optical device that effects a linear transformation of fields presented at two input ports, producing output beams that are related to the input fields in a characteristic manner

How Beamsplitters Work: Types, Mechanisms, and Applications

This article explains the working principles of beamsplitters, detailing how they divide a beam of light into two separate paths, the different types of beamsplitters available, and their various ...

Selecting the Right Beamsplitter

Selecting the Right Beamsplitter Beamsplitters are optical components that split light into two directions, and are available in many different designs. Are you interested in learning about the benefits and differences of the multiple types of beamsplitters offered by Edmund Optics, including plate, cube, pellicle, and

Understanding Beamsplitters: Types, Principles, and Applications

This article explores the fundamental principles and diverse applications of beamsplitters, detailing their different types and uses in fields such as optics and interferometry.

What is a Beam Splitter?

A beam splitter or power splitter is an optical device that can split an incident light beam e.g. a laser beam into two or sometimes more beams, which may or may not have the same optical

What are Beamsplitters?

Optical components that create two beams by splitting incident light are beamsplitters. Read more about the different types of beamsplitters at Edmund Optics.

Quantum physics and the beam splitter mystery

ABSTRACT Optical lossless beam splitters are frequently encountered in fundamental physics experiments regarding the nature of light, including “which-way” determination of light particles, N.

How does a beam splitter work? Common types and use cases

Understanding Beam Splitters Beam splitters are essential optical components used to divide a beam of light into two or more separate beams. They play a crucial role in various scientific,

Photonics 101

As the name suggests, a beam splitter refers to an optical device which is used to split or divide a beam of light into two. A beam splitter is usually the cornerstone of most interferometers.

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