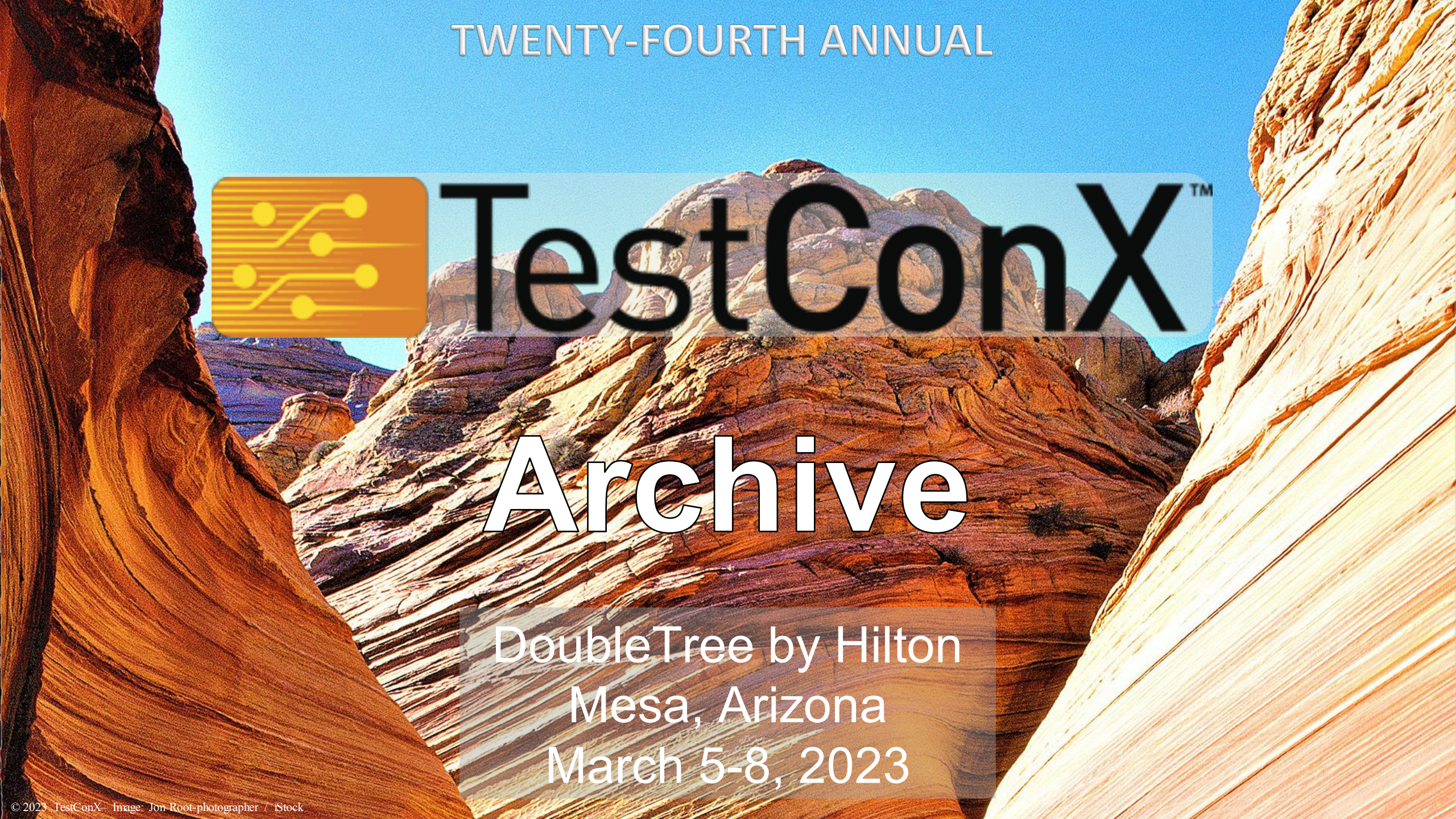

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Review of Polymer Materials Utilized in Test Socket Applications with a Comparison of Key Material Properties

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Objective

Compare material properties for high performance test socket applications.

Activity

Analyze mainstream materials used in test socket applications and compare their properties

Comparisons

Advantages of various manufacturing methods

- Extrusion
- Compression molding
- Laminate pressing

Disadvantages of various manufacturing methods

- Extrusion
- Compression molding
- Laminate pressing

Variables

Specify resin properties
Add a wide variety of fillers
Control manufacturing process variables

Test Socket Material Comparison

Product	TECAPEI GF30 natural	TECAPE EK natural	TECAPE EK CMF white	TECAPAI CM XP530 black-green	TECAPE EK LP TV20 beige
Resin type	PEI with glass fiber	PEEK	PEEK with ceramic filler	PAI with glass fiber	PEEK with proprietary filler
Tg DIN EN ISO 11357 (° C)	213	150[e]	151[e]	284	143[d]
Flexural Modulus DIN EN ISO 178 (MPA)	5500	4200	5500	5900	8600
CLTE 23-100° C DIN EN ISO 113591-1;2 ($10^{-5}K^{-1}$)	3	5	5	3.2	3.5[c]
Moisture Absorption-24 Hour DIN EN ISO 62 (%)	.04	.02	.02	.12	.08
Dielectric Constant 1 MHZ ASTM D 150	3.7[a]	2.8[b]	4.7	3.8	3.1
Elongation at Break DIN EN ISO 527-2 (%)	4	15	4	3.6	8.8
Process	extrusion	extrusion	extrusion	compression molding	laminate pressing

Notes:

[a]Testing at 1 kHZ, injection molded sample

[b]Test method DIN IEC 60250, 1 kHZ, injection molding data from public source

[c]Less than 150° C testing

[d]Values retrieved from raw material (films)

[e]DIN EN ISO 11357 public source

Summary of Test Socket Material Trends

Material Characteristics to optimize

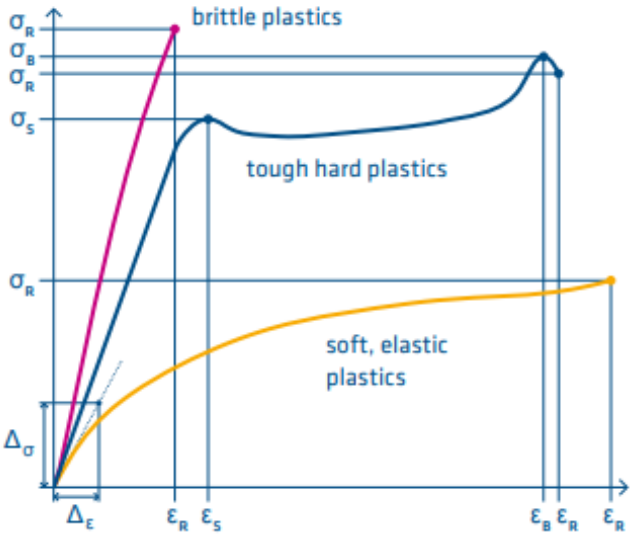
dimensional stability (flexural modulus, temperature resistance, water absorption)

wear resistance

dielectric properties

micro-machinability

Drilling 0.1 mm holes
TECAPEEK LP TV20 beige



σ_B Ultra-high tension
σ_R Tensile strength at break
σ_S Tensile strength at yield
ε_B Elongation under ultra-high tension
ε_R Elongation at break
ε_S Elongation at yield

material properties must be balanced so that polymers are not brittle and also provide rigidity.

- **Extrusion process**
  - proven technology to manufacture polymer plates that is cost efficient.
- **Compression molding**
  - more costly than extrusion
  - offers more uniform material properties
- **Laminate pressing**
  - extremely rigid products can be produced that also have excellent micro-machinability
  - custom thicknesses can be produced that can create cost saving opportunities

Conclusion

- Test socket engineers should consider the material type and the manufacturing process when selecting the optimum material for a given application.
- Polymer plate suppliers need to specify resin properties and consider fillers while also controlling process variables to optimize material properties.
- Suppliers of polymer materials are a critical element in the supply chain of test sockets and can play an important role in the development of new materials.