Sustainable Shoes: Utilizing Innovative Technology To Eliminate Chemical Adhesives

**Introduction**

300 million shoes are thrown away annually. 90% of these shoes end up in landfills. They take 40 years to decompose. This is unacceptable.

In order to recycle the upper and soles of Under Armour™ shoes, the materials must first be efficiently separated from each other, which is where the difficulty emerges.

Under Armour™ is a global athletic wear giant based in Baltimore. For the past decade Under Armour™ has been pursuing solutions to make their products and their business more environmentally sustainable. Their goal is to design, manufacture and sell fully recyclable shoes.

**Defining the Need**

Under Armour™ seeks to utilize innovative designs that align with their sustainability goals and improve the component assembly and disassembly of their shoes in order to improve reusability.

They have come to our team in hopes that our technical backgrounds and detailed research will produce a sneaker design that is aligned with their sustainability goals. Through our partnership we designed a shoe for Under Armour™ so that the recyclable components can be quickly and easily disassembled in order to be reused or recycled to improve sustainability and lower UA’s carbon footprint.

**Criteria**

We conducted a plethora of interviews to collect first-hand technical research and expertise on the textiles, footwear, and sustainable consumer goods market. We interviewed different groups of people including UA employees, university professors, and textile experts. The design criteria below summarizes our most crucial technical findings through research and interviews.

<table>
<thead>
<tr>
<th>Level of Sustainability</th>
<th>Ease of Assembly</th>
<th>Ease of Disassembly</th>
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<tr>
<td>Athletic Performance</td>
<td>Timeline to Feasibility</td>
<td>Consumer Perception</td>
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**Testing: Zipper Shoe**

**Ease of Assembly & Disassembly**

- **Sole assembly takes ~5 minutes via clamp tool**
- **Attaching bottom half of zipper to industrial sole mold cures for ~2 hours**
- **Disassembly via manual unzipping takes ~5 seconds**

**Integration to UA Manufacturing**

- **Create Mold**
  - Manufacture a thermoplastic mold of the sole in various shoe sizes (singular investment)
- **Industrial Molding**
  - Using an industrial molding process, a recyclable zipper will be added into the cast of the thermoplastic sole mold (manufacture or external vendor)
- **Sew Zipper to Upper**
  - Using sewing machinery already in UA manufacturing
- **Manually Zip Upper to Sole**
  - (~10 sec per pair)
- **Manually Unzip Upper from Sole**
  - (~10 sec per pair)

**Solution 1: Zipper Shoe**

This solution mechanically zips the upper to the sole by incorporating zipper teeth into the sole of the shoe.

**Solution 1: Zipper Shoe**

This solution connects the upper and sole with a screw-like rivet aligned to the edge of the sole.

**Meet the Team**

- Anya, BME ‘23
- Claire, ChemBE ‘23
- Callie, ChemBE ‘23
- Victor, MechE ‘23

Watch our video!