

The study employed a self-developed 50t multi-axis fatigue electro-hydraulic servo test system, capable of conducting various tests such as uniaxial dynamic stretching, biaxial dynamic stretching, uniaxial tensile fatigue, and three-point bending fatigue tests, as presented in Figure 1a. The equipment is jointly developed by Shenyang Aerospace University and Shenyang Hongderun HVAC Equipment Co., Ltd., including a low-temperature chamber, a universal testing machine from Changchun Xintai Testing Machine Co., Ltd., Polymers 2023, 15, 1648 3 of 14 and self-made three-point bending fixtures